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Early Permian vertebrate ichnofauna from South Alpine Region (Northern Italy): ichnosystematics, paleoecology and stratigraphic meaning

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ABSTRACT

Studies on Early Permian tetrapod ichnofauna emphasized the scarcity of forms from Italian sites. A revision work on the entire collections revealed the presence of Hyloidichnus bifurcatus *Gilmore*, *1927 and* Limnopus heterodactylus *(King, 1845). The ichnoassociation now lists seven ichnogenera:* Amphisauropus, Batrachichnus, Dromopus, Erpetopus, Hyloidichnus, Limnopus, Varanopus. *These new data enlarge the ichnoceonosis, adding tracks of medium-size captorhinomorphs (*Hyloidichnus*) and temnospondyls (*Limnopus*) to the Italian ichnofauna, previously characterized by scarcity of predators and amphibians. Radiometric ages give a strong age constraint to the ichnoassociation (Early Kungurian), allowing useful correlations to contemporary successions all over the world. The main difference is the absence of* Ichniotherium *and* Dimetropus*, and this could have a stratigraphic or paleoenvironmental significance. The fauna is similar in the two main basins (Collio and Orobic Basins). It differs solely in the proportions between ichnotaxa, with a predominance of areoscelid traces* (Dromopus) *in the Collio Basin and of captorhinomorph traces (*Erpetopus, Varanopus, Hyloidichnus*) in the Orobic Basin. This datum could reflect slightly different environments, seasonal in the Collio Basin (alluvial plain) and more arid in the Orobic Basin (playa-like). The lack of some forms in smaller basins of the Athesian Volcanic Complex is probably due to a bias.*

RIASSUNTO

Gli studi sull'icnofauna a tetrapodi del Permiano inferiore hanno finora enfatizzato la scarsezza di forme dai siti italiani. Un lavoro di revisione sull'intera collezione ha rivelato la presenza di Hyloidichnus bifurcatus *Gilmore, 1927 e di* Limnopus heterodactylus *(King, 1845). L'icnoassociazione ora comprende sette icnogeneri:* Amphisauropus, Batrachichnus, Dromopus, Erpetopus, Hyloidichnus, Limnopus, Varanopus. *Questi nuovi dati allargano l'icnocenosi, aggiungendo impronte di captorinomorfi (*Hyloidichnus*) e temnospondili (*Limnopus*) all'icnofauna italiana, prima caratterizzata da una scarsezza di predatori ed anfibi. Datazioni radiometriche danno una collocazione stratigrafica precisa all'icnoassociazione (Kunguriano inferiore), consentendo utili correlazioni con associazioni contemporanee di tutto il mondo. La differenza principale è la mancanza di* Ichniotherium *e* Dimetropus*, questo potrebbe avere un significato stratigrafico o paleoambientale. La fauna è simile nei due bacini principali (Bacini di Collio ed Orobico). Differisce solamente nelle proporzioni tra icnotaxa, con una predominanza di tracce di areoscelidi (*Dromopus*) nel Bacino di Collio e di tracce di captorinomorfi (*Erpetopus, Varanopus, Hyloidichnus*) nel Bacino Orobico. Questo dato potrebbe riflettere ambienti leggermente differenti, stagionale nel bacino di Collio (piana alluvionale) a più aridi nel bacino Orobico (ambiente di playa). La mancanza di alcune forme nei più piccoli bacini del Complesso Vulcanico Atesino è probabilmente dovuta ad una mancanza di dati.*

1) INTRODUCTION

The study of vertebrate footprints is the key to understand the ancient composition of the fauna, and to make inferences on stratigraphy, paleoenvironments and paleobiogeography of an area. This is also true for a revision work: the analysis of all the material, coming from different sites and stratigraphically located, with a careful observance of facies and other fossils, permits a reliable reconstruction of the ichnoassociation, linked to a precise moment of the geological time in a precise paleoenvironment. This datum can be correlated with coeval associations in other areas, raising interesting points of discussion.

The other remarkable results from this kind of studies are the solution of some ichnologic matters: the analysis of a complete range of footprint specimens with different state of preservation, coming from different facies, showing different behaviors of the trackmakers, permits some reliable considerations on ichnotaxonomy, preservational styles, behaviors and environments. In this case the effect of the extramorphologies (i.e. deformations on footprints linked to gait, substrate and preservation) can be controlled and the optimally-preserved footprints recognized, allowing taxonomic and statistical studies.

The environments where these fossils form and preserve are continental or peritidal. In the first case the stratigraphic constrain from marine fossils is completely absent, and the correlation between different units becomes difficult, because of frequent and large lateral changes of the sedimentary bodies and frequent stratigraphic hiatus.

The significance of tetrapod fossil footprints is even more important in areas without a good fossil bone record, or other fossils useful for stratigraphy. This is the case in the Early Permian continental formations of the Southern Alps area (northern Italy). The tetrapod ichnites and invertebrate traces constitute the most abundant fossil remains, since bone fossils are unknown (apart a carbonized body of an areoscelid reptile, *Tridentinosaurus antiquus*) and other fossils are scarce and not optimally preserved (fossil plants, bivalves, crustaceans). Also microfossils are badly preserved (sporomorphs). These reasons alone underline the necessity of a complete and serious work on the tetrapod ichnofauna of the continental Early Permian of the Southern Alps.

Tetrapod footprints are unquestionably the main fossil remains in continental sediments of the Early Permian of the South Alpine region and in the past they were used to understand paleoenvironments (Ronchi and Santi, 2003), to correlate basins (Cassinis et al., 2002; Cassinis and Santi, 2005) and also as stratigraphic tools (Conti et al., 1997; Avanzini et al., 2001; Ronchi et al., 2005).

The main Early Permian continental basins of this region are the Collio Basin (Collio Fm.) and the Orobic Basin (Pizzo del Diavolo Fm.), in the Lombardy region. Fossils also come from smaller basins linked to the Athesian Volcanic Group, like Monte Luco (Mt. Luco epiclastic units) and Tregiovo (Tregiovo Fm.), in the Trentino Alto-Adige region.
The age of these basins, established with radiometric dating of volcanic rocks at the base and the top of the sedimentary successions, is Artinskian-Kungurian, data confirmed by tetrapod ichnocenosis, macroflora and microflora (sporomorphs).
Numerous ichnological studies on tetrapod footprints have been carried out since the 19th century (first reports by Geinitz, 1869 and Curioni, 1870). The subsequent works proved the presence of a reduced ichnofauna in the Early Permian of these regions, even smaller than contemporary basins of Germany, France and the United States. It was noted that there is a predominance of small forms, in an apparently unbalanced association, further reduced in younger sediments (Conti et al., 2000; Santi, 2005; Avanzini et al., 2008). The present revision of studied and new material, stored in various institutes and museums, was needed to better understand the meaning and completeness of the ichnoassociation.
This kind of study was never attempted, and the reasons are several. Fossil footprints of this area are known since the 19th century, but most of the material has been found in the last 30 years, and ichnologists never tried a comprehensive study on it, also because they focused their attention to the Late Permian and Mesozoic ichnofaunas. The result is an underestimation of Early Permian ichnoassociation of Italy, and huge quantities of material never described or published. Most of the works are merely descriptive and correlation between different basins and formations was done reporting other researches, so the grade of subjectivity has increased.
This study has several objectives: 1) the use of a clear ichnological approach, mixing new techniques with traditional methods, 2) the study of all the Early Permian specimens of the Southern Alps, with the record of the provenance and the storing of all the material, 3) the record of all the fossiliferous localities, linked to a correct stratigraphic and paleoenvironmental framework, 4) the estimate of the taxonomic, behavioral, stratigraphic and paleoenvironmental significance of the Italian ichnoassociation, in a wider European and extra-European context.

2) GEOLOGICAL SETTING

The Permian of the South Alpine region is characterized by two distinct tectono-stratigraphic units (TSU), separated by a marked Middle Permian unconformity of about 10 Ma (Cassinis et al., 1988). They correspond to two sedimentary cycles: the first develops over the crystalline basement, it is characterized by the deposition of fluvio-lacustrine sediments (Collio and Pizzo del Diavolo Fms.) and volcanic bodies and it is Early Permian in age; the second is dominated by alluvial sedimentation and is Mid?-Late Permian (red beds of the Verrucano Lombardo/ Val Gardena Fms. The first TSU is probably the result of the opening of Paleotethys on the East, which caused a transtensional tectonic movement on the Hercynian Orogene. Other hypothesis include: collapse of the Varisican belt, wrenching of some sectors of Southern Europe, and backarc basin developement (Berra & Felletti, 2011). In this context some tectonic depressions formed in the Southern Alps, between metamorphic and igneous paleo-highs. From the East to the West we recognize: the Biella Volcanics, the Varese-Lugano District, the Orobic Basin, the Collio Basin, the Tione Basin, the Athesian District and the Pramollo Basin, pull-apart basins formed due to a dextral tectonic movement along the main lineaments (Canavese, Insubric, Giudicarie and Pustertal lines). These basins are filled with volcanic rocks, pyroclastites, tuffs and silicoclastic rocks as conglomerates, arenites, siltites, pelites and are also associated with plutonic rocks.

Volcanic episodes and sedimentary successions alternate variously, and lateral and vertical changes of these bodies are quite common, the thickness is very variable and the geometries are complex. The fossiliferous basins, as regards the trace fossils, are the Orobic Basin, the Collio Basin and the Athesian Volcanic Complex. They are mainly characterized by alluvial or lacustrine deposition, with very variable thickness (from 0 to 1500 m) and frequent intercalations of volcanic bodies of calc-alkaline acidic and intermediate composition, with a thickness up to 2000 m (in the Athesian Volcanic Complex).

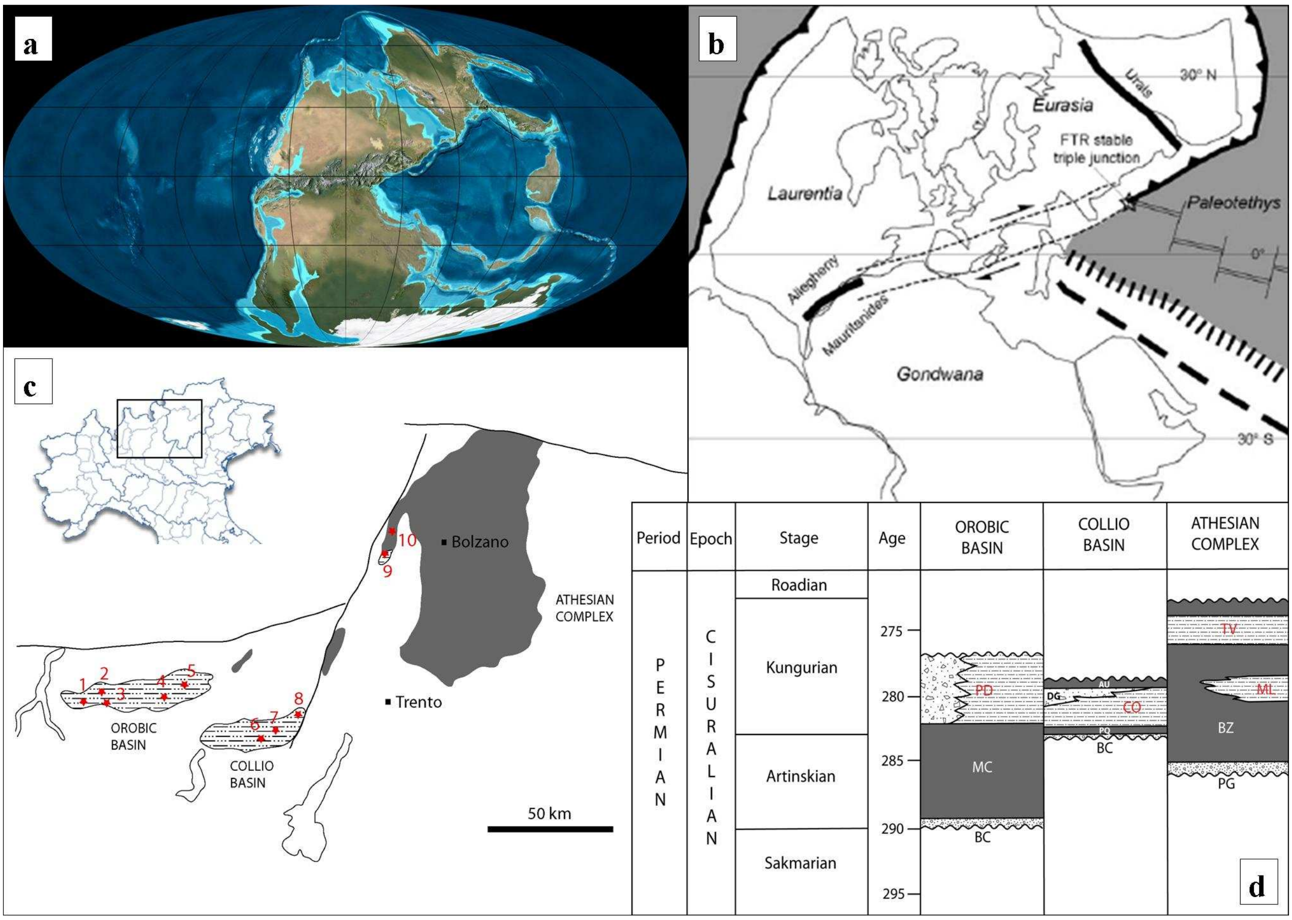

FIG 1. Geological setting of the Southern Alps area in the Early Permian. a) Paleogeographical reconstruction of the Early Permian world. b) Structural scheme of the opening of the Paleotethys and consequent tectonic movement on the Hercynian Orogene, main cause of the formation of the Italian continental basins (from Cassinis et al., 2012, modified). c) The Orobic Basin sites: Val Gerola (1), Monte Ponteranica (2), Val di Scioc (3), Laghi Gemelli (4), Val Brembana (5). The Collio Basin sites: Val Trompia (6), Val Caffaro (7), Val di Chiese (8). The Athesian District sites: Tregiovo (9), Monte Luco (10). d) Chronostratigraphical scheme of the Italian Early Permian continental formations. BC: Basal Conglomerate, MC: Monte Cabianca Fm., PD: Pizzo del Diavolo Fm., PQ: Lower Quartz Porphyries, CO: Collio Fm., DG: Dosso dei Galli Fm., AU: Auccia Fm., PG: Ponte Gardena Conglomerate, BZ: Bolzano Porphyries, ML: Monte Luco epiclastics, TV: Tregiovo Fm.

1. The Orobic Basin

This continental basin is extended for about 60 km in E-W direction and is constituted by three "anticlines": the Orobic, the Trabuchello-Cabianca and the Cedegolo (Ronchi et al., 2005).
It has an asymmetrical semi-graben structure, with a thickness strongly increasing from the South to the North (Boriani et al., 2012). It has been defined a "multi-stage" basin, because the volcanic activity and the successive sedimentary infilling have different depocentres (Cadel, 1986).

The fossil content of this Basin is almost exclusively constituted by tetrapod and invertebrate traces, which are very abundant and frequently well-preserved (Nicosia et al. 2000, Santi & Krieger, 2001, Arduini et al., 2003, and Santi, 2007). The age of the ichnoassociation is late Early Permian (Artinskian-Kungurian). Rare plant remains are attributed to *Walchia* isp. and *Cassinisia Orobica* Kerp et al., 1996. A supposed shark-egg case, of the *Fayolia* genus, has been described by Ronchi & Santi (2003). A temporary opening to the sea was suggested by the findings of foraminifers (Sciunnach, 2001), but the preservation of the material makes this assumption doubtful.

Recently, a revision of the lithostratigraphic nomenclature of the Orobic Basin has been proposed in the geological mapping project 1:50000 of Italy (CARG), in the Clusone and Sondrio sheets (Jadoul et al., 2012, Boriani et al., 2012). What was previously known as "Collio vulcanico" and "Collio sedimentario" (Casati & Gnaccolini, 1967) is now respectively "Monte Cabianca Fm." and "Pizzo del Diavolo Fm.". Also the conglomeratic units interbedded with the "Collio sedimentario" (e.g. "Monte Aga", "Ponteranica") have been included in the "Pizzo del Diavolo Fm.". The units from the Basal Conglomerate to the overlain Monte Cabianca and Pizzo del Diavolo Fms. now constitute the "Laghi Gemelli" Group, overlained with angular unconformity by the Upper Permian red beds of the Verrucano Lombardo Fm. The main purpose of this choice is to differentiate the sedimentary and volcanic units of the Orobic and Collio basins. The use of "Collio Fm." for both basins has been considered too confusing and unrealistic, since they develop in different paleotectonic and paleogeographic settings, even if the age and the facies are similar.

The deposition begins with the Basal Conglomerate, which is very discontinuous and overlain the metamorphic basement. It is constituted by poorly sorted conglomerates, breccias and coarse-grained sandstones, reddish or grey-green in color. It contains abundant fragments of the eroded metamorphic basement and less frequent volcanic clasts. It has been interpreted as proximal alluvial fan-braided setting.

The successive unit is the Monte Cabianca Fm. (500-1000 m), constituted by volcanoclastics and less frequent volcanic and sedimentary units. The volcanic units have calcalkaline composition and a crustal-anetettic origin. Inside the formation, some units can be recognized (Boriani et al., 2012): welded and porphiric violet tuffs, basaltic lava flows, stratified sedimentary deposits, flow and fall pyroclastites. The sedimentary deposits are constituted by medium-coarse arenites, with subordinate conglomerates and fine pyroclastites, and interpreted as braided settings, sometimes interested by fine pyroclastic deposition.

Radiometric data with U-Pb methods on zircons in the ignimbrites give different results, suggesting a Late Early Pemian (Artinskian-Roadian) age for this Formation: 288 Ma, Cadel et al. (1987); 280 Ma, Philippe et al. (1987); 279 and 270 Ma, Berra et al. (2008).

This unit is overlained by the sedimentary Pizzo del Diavolo Fm., which reaches a thickness of more than 600 m. A possible typical section was described by Ronchi et al. (2005) in the "Val Camisana" and "Bocchetta Podavit" localities.

This formation is constituted by laminated pelites and siltites, arenites, conglomerates and less frequent and thinner freshwater carbonatic and reworked pyroclastic intervals. The finer levels are alternated vertically and laterally with the coarser ones in a complex geometry, result of an alluvial to lacustrine environment with alluvial fans on its sides.

An example of this is explained in Berra & Felletti (2011), in a study of the central-southern area of the basin. They distinguished three lithozones: a lower one with conglomerates to arenites and pelites from the southern to the northern sectors of the basin (from alluvial fan to sandy sheet and floodplain environments), a middle one with laminated pelites and microbial carbonates, and an upper one with sandstones and volcanic tuff levels, passing upwards to fine sandstones and siltstones associated with oncoidal carbonates (floodplain environment with ephemeral lakes).

These lithofacies have been distinguished in the Formation (Boriani et al., 2012): 1) lithofacies with prevailing pelites, 2) lithofacies with prevailing arenites, 3) conglomeratic lithofacies, 4) carbonatic-evaporitic lithofacies, and 5) interbedded volcanics.

The lithofacies with prevailing pelites is constituted by black massive or, more frequently, laminated siltites and pelites interbedded with grey and brownish arenites. Sedimentary structures include: symmetrical and asymmetrical ripples, plane and cross lamination, mud cracks, clay chips, rain drops. Fossil footprints of vertebrates and invertebrates are very common and often optimally-preserved, the association is similar to that of Collio Basin (Nicosia et al. 2000, Santi & Krieger, 2001, Arduini et al., 2003, and Santi, 2007). Soft-sediment deformation and liquefation structures are very common (Ronchi et al., 2005, Berra & Felletti, 2011). In some areas, the diffuse cleavage testifies to an incipient alpine metamorphism (this is the meaning of "Scisti of Carona"). The lithofacies with prevailing arenites is constituted by grey or light-brownish lithic sandstones, massive or stratified, with cross stratification, load structures, ripples, fining and coarsering upwards cycles. The clast come mainly from volcanic rocks. Pelitic, volcanoclastic and conglomeratic levels are also present.

The conglomeratic lithofacies is constituted by poorly sorted coarse-grained arenites and conglomerates with clasts deriving from the underlying volcanic rocks and metamorphic basement. These units can be very thick, but not laterally extended, the deposition is typical of alluvial fans. Three petrofacies, corresponding to three different conoid systems, have been described (Cadel et al., 1996). The carbonate-evaporitic lithofacies is characterized by thin and discontinuous levels of lacustrine carbonates, with algal oncoids or stromatolites, interpreted as ephemeral lakes in arid environments (playa-like, Ronchi et al., 2005). It is associated with tetrapod and invertebrate traces, this datum testifies to its ephemeral character (Berra & Felletti, 2011).

2. The Collio Basin

This is the most studied and best-known continental basin of the Early Permian of the Southern Alps (Cassinis, 1966, Cassinis, 1983, Ori et al., 1986, Cassinis, 1999, Cassinis & Perotti, 2007, and Cassinis et al., 2012). It is situated in the Brescian Prealps and is extended for more than 20 km in WSW-ENE direction, its shape is sigmoidal, which is a typical feature of pull-apart basins. It is bounded by the Giudicarie and Trompia lines respectively on the East and the South. The latter could represent the southward continuation of the Giudicarie line (Cassinis, 1983). It is separated from the Orobic Basin and Boario Basins to the North-West sectors by two paleo-highs (the first is known as "Dorsale Camuna").

The Collio Basin has a typical semi-graben structure, with a depocenter close to the eastern border, where the thickness reaches 1200-1500 m (in the Caffaro Valley, Breikreutz et al. 2001, Cassinis et al., 2012). The infilling is sedimentary and volcanic, with the units alternating and interfingering in complex geometries. Two superimposed tectonic phases have been recognized by Ori et al. (1988), both with basal volcanics (lower Porphyries and Dasdana beds) and sedimentary successions (Pian delle Baste and Val Dorizzo members of Collio Fm.), characterized by an upward thinning of strata and granulometry, from conglomerates to pelites, in environments passing from alluvial fan to sand sheet and floodplain/lacustrine. After these two episodes of subsidence, the basin has gradually been infilled by conglomerates and sandstones (Dosso dei Galli Fm.) in a coarsering-upwards trend, a volcanic event closes the Early Permian succession (Auccia Volcanics). The Upper Permian Verrucano Lombardo Fm. lies above, in an angular unconformity of about 10°. In the most eastern sectors the Early Permian succession is overlained by the Val Daone Conglomerate, considered Middle Permian in age by some authors (Cassinis et al., 2008, Gretter et al., 2013).

The Collio Basin developed between 283.1 ± 0.6 Ma and 279.8 ± 1.1 Ma, from U-Pb age determinations on the Lower Porphyries and the Auccia Volcanics (Schaltegger & Brack, 2007), thus the age is Late Artinskian-Early Kungurian.

Fossils found in the sedimentary Collio and Dosso dei Galli Fms. are mainly vertebrate and invertebrate traces (Curioni, 1870, Berruti, 1969, Haubold & Katzung, 1975, Ceoloni et al., 1987, Conti et al., 1991, Conti et al., 1997, Ronchi, 2008, Contardi & Santi, 2009, and Avanzini et al., 2011) and less abundant plant remains (Geinitz, 1869, Remy & Remy, 1978, and Visscher et al.,

2001), bivalves and rare crustaceans (Berruti, 1969, Conti et al., 1991). Also palynomorphs were studied (Clement-Westerhoff et al., 1974, Cassinis & Doubinger, 1991, 1992).
Tetrapod footprints association indicates a Kungurian-Ufiman age (Conti et al., 1997); plant fossils are not useful for stratigraphy, since no cuticles are known (Visscher et al., 2001) and palynomorphs give a Late Artinskian-Early Ufimian age (Neri et al., 1999).
The deposition in the Collio Basin begins with the Basal Conglomerate, which lies discontinuously and unconformably on the metamorphic basement, and includes abundant clasts from the latter.
The first pulses of volcanic activity produced the unit known as Lower Porphyries (0-100 m), rhyolithic ignimbrites with a thickness strongly increasing to the western part of the Basin. Up to four different ignimbritic units can be recognized, interlayered with tuffs and conglomerates (Breitkreuz et al., 2001).
The overlain unit is the mostly sedimentary Collio Formation (up to 500 m), now divided into two parts: the Pian delle Baste and Val Dorizzo members. A classical section of the Collio Formation has been described by Cassinis (1966), on the eastern slope of Mt. Dasdana, and divided into seven parts (A-G), including also the Lower Porphyries (A), and parts of the Dosso dei Galli Fm (G).
Ori et al. (1986) gave a careful description of the facies of the two members. From the W to the E part of the basin, and from the base to the top, they recognized in both members a passage from disorganized conglomerates, pebbly sandstones and mudstones in strata of 30-120 cm, discontinuous with erosional bases (distal fan), to horizontally-bedded and laterally-continuous coarse sandstones in strata of 10-40 cm, sometimes lenticular, showing normal grading, horizontal lamination, and small-scale cross lamination (sand flat); to shaly facies with subordinate fine sandstones, containing mud cracks, ripples, abundant organic matter, plant debris and tetrapod footprints (mudflat/distal lacustrine). The source area was probably to the south, as testified by ripple and slump orientations.
These two sedimentary units are divided by pyroclastic beds, the "Dasdana Beds" (0-25 m), originating from the Eastern part of the Basin, with a thickness strongly decreasing to the West. This unit testifies to a new tectonic activity (Ori et al., 1986) and includes abundant lithic fragments of the underlying Pian delle Baste Member. This fact was interpreted as subaerial erosion of the pyroclastic flow (Cassinis, 1966) or, more recently, as the eruption of a sublacustrine cryptodome (Breikreutz et al., 2001). In the most eastern sectors of the basin, volcanic pulses produced the Monte Macaone Fm., with lavas and volcanoclastic units contemporary and successive to the deposition of the Val Dorizzo Member.
The Collio Fm. passes gradually to the Dosso dei Galli Fm. (0-540? m). This is constituted by disorganized conglomerates, coarse sandstones and subordinate fine bioturbated facies (Pietra

Simona). This Formation is interpreted as prograding alluvial fans that progressively closed the basin, from the West to the East (Ori et al., 1986, Cassinis, 1999), and is informally divided into two units: a lower one with different coarsering-upward cycles interfingering with the upper parts of the Collio Fm., and an upper one with disorganized conglomerates and coarse sandstones.
The lenticular red fine sandstones of the Pietra Simona shale were interpreted as lateral or inactive parts of the alluvial fans, and preserve pervasive bioturbation (Ronchi, 2008) and tetrapod footprints (Conti et al., 1991, 1997). The succession ends with the last episode of volcanic activity, the Auccia Volcanics (0-140 m), rhyolithic ignimbrites partially eroded by the overlain Upper Permian Verrucano Lombardo red beds.

3. The Athesian District

The Athesian Volcanic Group, also known as the "Bozner Quarzorphyr", together with the intrusives of Cima d'Asta, Bressanone, Ivigna, Monte Croce and Monte Sabion, constitutes the major Permian vulcanoplutonic system of the central and eastern Southern Alps (Marocchi et al., 2008). It extends between the Trento and Bolzano provinces and is bounded by the Giudicarie Line to the west, by the Valsugana Line to the South, by the Funes Line approximately to the north, and the eastern margin is determined by a N-S tectonic alignment (Cassinis & Neri, 1990).
Its development is strongly linked to the tectonic activity, and the volcanic activity is mainly constituted by pyroclastic flows, with subordinate domiform extrusions, lava flows, rare pyroclastic surge and fall deposits (Avanzini et al., 2007). The volcanic rocks range from andesites to rhyolites, the intrusives from gabbros to monzogranites, in a typical calcalkaline suite (Marocchi et al., 2008). The average thickness is about 2000 m, in the basal part it lies unconformably on the metamorphic basement or on the Basal Conglomerate and it is overlained by the Upper Permian sandstones of the Val Gardena Fm., passing to the east into the marine Bellerophon Fm. Continental clastic sediments are present at different levels of the volcanic sequence, in sub-basins that testify to a stasis of the volcanic activity and are strongly controlled by the sinsedimentary tectonics (epiclastics of Monte Luco Fm., Guncina Fm., Tregiovo Fm., and Varano Fm.).
The best-known ones are the Tregiovo and Monte Luco Basins (Gianotti, 1962, Astl & Brezina, 1986, Cassinis & Neri, 1992, Neri et al., 1999, and Avanzini et al., 2007), mainly because of their fossil content.
One of the most remarkable fossils from the Athesian District is the carbonized body of an areoscelid reptile (*Tridentinosaurus antiquus*), found in an epiclastic layer in the locality of Pinè

(Trento province) and described by Leonardi (1959); it constitutes the only body fossil remain known from the Early Permian of the Southern Alps.

Fossil traces of vertebrates and invertebrates were studied by Conti et al. (1997, 1999), Avanzini et al. (2008, 2011), and testify to a poor ichnoassociation. The Tregiovo association was considered "monotypical", with the only *Dromopus* ichnotaxon, and was assigned to Kungurian-Ufimian? (Conti et al., 1997, Avanzini et al., 2001). The one of Mt. Luco is more diversified and probably slightly older (Avanzini et al., 2008).

The plant fossils of Tregiovo Fm. were studied by Remy & Remy (1978), Kozur (1980), and Visscher et al. (2001), which attribute them a generic Early Permian age. Studies on the macroflora in the locality of Sinnich, probably pertaining to the Mt. Luco Fm. (Morelli et al., 2007, Marocchi et al., 2008) indicate a Late Artiskian age (Fritz & Krainer, 2006).

Fossil palinomorphs of the Tregiovo Fm. were investigated in Cassinis & Doubinger (1991, 1992), Barth & Mohr (1994) and Neri et al. (1999), assigning a Kungurian-Ufimian? age. Well-preserved miospores from the locality of Grissian, now included in the underlying Guncina Fm. (Avanzini et al., 2007), indicate semi-arid to arid conditions and an Artinskian-Kungurian age (Krainer & Spötl, 1998, Hartkopf-Fröder et al., 2001). Other fossils found in the Tregiovo Fm. are ostracods and conchostraceans (Cassinis & Neri, 1990).

U-Pb radiometric data on zircons, together with a stratigraphic review of the NW sectors of the Athesian Volcanic Group in the Italian geological mapping project CARG (Avanzini et al., 2007, Morelli et al., 2007, and Marocchi et al., 2008) emphasize that volcanic activity and deposition developed between 285 and 274 Ma. The Monte Luco epiclastic units have an age of 279.6±1.1 Ma (Monte Luco Fm.), the Tregiovo Fm. has an age between 276.5±1.1 Ma (Gargazzone Fm.) and 274.1±1.6 Ma (Ora Fm.), so they pertain to the Late Kungurian.

The Tregiovo Fm. has been divided into two facies: a conglomeratic one and a pelitic one (Avanzini et al., 2007). The conglomeratic facies (50-60 m) is mainly developed at the base of the succession, and sometimes it is observable also on the top. It has been interpreted as fault-scarp alluvial fan, developed at the opening of the sub-basin (normal grading, fining-upwards trend) and at its closure (inverse grading, coarsering-upwards trend) by Cassinis & Neri (1990).

It is constituted by coarse and unsorted volcanic conglomerates, with centimetric or decimetric clasts, and stratified coarse sandstones with cross-trough bedding and parallel lamination.

The pelitic facies (80-200 m), also known as "Scisti of Tregiovo", is composed by black laminated mudstones and siltstones, deposed in tabular thin strata (1-10 cm), with subordinate fine arenites (10-70 cm). This recognizable bedding style has been defined as "verved like" by some authors

(Cassinis & Neri, 1990, Neri et al., 1999). The most common sedimentary structures are normal grading, planar lamination, mud cracks, and ripple marks (Cassinis & Neri, 1990).

This facies is also characterized by diffuse mineralizations of Pb-Zn and chert in levels and lenses, also carbonatic intervals and intraclastic breccias are observed (Astl & Brezina, 1986).

The fossil content of these strata is remarkable and include tetrapod footprints, fossil plants, ostracods and choncostraceans. The environment was probably wet floodplain to lacustrine, in moments of tectonic stability.

The epiclastic units of the Monte Luco Fm. (70-90 m) have recently been described by Avanzini et al. (2007), which recognized the presence of highly-variable facies. Avanzini et al. (2008) distinguished three lithozones: a lower one with paraconglomerates including fragments of the metamorphic basement (alluvial fan), passing upwards to stratified and horizontal-laminated arenites (sheet-flood); a medium one with fine dark laminated limestones, mudstones and siltstones with chert lenses and mud cracks, rain drops and tetrapod footprints (lacustrine in semi-arid settings); and an upper one with facies similar to the basal conglomerates and sandstones (alluvial fan). The vertebrate and invertebrate ichnoceonosis was described by Avanzini et al. (2008) and Avanzini et al. (2011), other fossils include carchoalified plant fragments.

3) PREVIOUS WORKS

Collio Basin

The first description of vertebrate fossil footprints in the Early Permian of Southern Alps is from Curioni (1870), in a careful work on the geology of the Trompia Valley (Brescia province). The examined slab was found by Don Bruni and comes from the locality known as "Pulpito", in the Val Trompia site (Collio Fm., Collio Basin). It is the first description of vertebrate fossil footprints from Italy and also the first known description of the *Amphisauropus kablikae* ichnotaxon (Geinitz & Deichmüller, 1882), so it is worth quoting it: **" Nella fig.1 presento il disegno delle impronte fisiologiche raccolte al Pulpito, a ponente delle sorgenti del Serimand. La lastra contiene tre impronte di piedi. Le due impronte estreme sono evidentemente pentadattili, ma non hanno alcuna rassomiglianza con quelle del *Cheirosaurus Barthii*, Kaup., nè con quelle del *Labirinthodon*, Ow., e neppure con quelle dell'animale sconosciuto di cui parla Buckland, e da lui figurato nella tavola 26 della sua celebre opera: *Geology and Mineralogy*. Queste due impronte presentano la direzione del piede inferiore a dritta e di quello superiore a manca, ma tra queste due impronte, che distano dalla parte superiore della più bassa alla parte inferiore della più alta di 12 cent., avvene un'altra, quasi equidistante dalla prima, la quale sgraziatamente è incompleta, per rottura della lastra. Non presenta che quattro dita; il dito medio, nel supposto che ne manchi uno, ha una forma uncinata. Il prof. Geinitz, dietro l'esame di uno schizzo eseguito dal signor Bruni, dice che queste impronte si avvicinano a quelle figurate dal Buckland pel *Chelychnys Dunkani* del Bundersandstein di Dumfries: ma queste nostre impronte trovansi nel terreno permiano. Sulla medesima lastra si vedono qua e là impronte di *Ornithichnites*." (p. 27).**

Subsequent works reclassified the footprints of this specimen as *Chirotherium, Saurichnites* (in Gümbel, 1880), and *Amphisauropus latus* (in Ceoloni et al., 1987). Later this site was studied by Berruti (1969), which recovered numerous slabs with fossil footprints from 4 different localities of the Dasdana Valley, after the advice of Cassinis (1966). Berruti identified *Eumechichnium gampsodactylum*, *Thecodonthichnus* sp., *Prochirotherium permicum*, *Ichnium acrodactylum tambacense*, and *Ichnium sphaerodactylum tambacense*. He also classified as *Eumechichnium gampsodactylum* one of the two slabs found in 1873 by D. Bruni in the nearby locality known as "La Cuta". Haubold & Katzung (1975) revised the material and identified these ichnospecies:

Antichnium salamandroides, *Amphisauropus imminutus*, *Amphisauropus latus*, *Dromopus lacertoides*, and cf. *Gilmoreichnus brachydactylus*.

Ceoloni et al. (1987) restudied the specimens and abandoned all the determinations of Berruti and some of those of Haubold & Katzung: they instituted a new ichnogenera (*Camunipes*) and two new ichnospecies (*Camunipes cassinisi* and *Gracilichnium berrutii*). They also identified *Dromopus lacertoides* and *Amphisauropus latus*.

After new extensive field work in 15 new and historical fossiliferous localities in the Val Trompia site, Conti et al. (1991) also recognized *Amphisauropus imminutus, Varanopus* sp., ?*Laoporus dolloi*, *Laoporus* sp. and proposed a preliminary stratigraphic distribution of the ichnotaxa.

A chronostratigraphic study on this ichnofauna was tempted by Conti et al. (1997), basing on the stratigraphical distribution at 11 different levels of the ichnotaxa *Amphisauropus latus*, *Dromopus lacertoides*, *Dromopus didactylus* and *Ichniotherium cottae;* the last two were identified for the first time in the Early Permian of Italy.

Haubold (1996), in a work of revision of the european forms, considered the material identified as *Gracilichnium berrutii* Ceoloni et al., 1987 as footprints with an undertrack preservation of *Batrachichnus salamandroides* (Geinitz, 1861), so the ichnospecies was invalidated.

After the meetings of Halle (1997) and Brescia (1999), the ichnospecies *Laoporus dolloi* was invalidated and considered as undertrack preservation of *Amphisauropus*, and the validity of the *Dromopus didactylus* and *Camunipes cassinisi* ichnotaxa was questioned.

After Santi (2005), who synthesized all the previous works, the ichnofauna from the Collio Fm. from the Collio Basin includes: *Amphisauropus imminutus*, *Amphisauropus latus*, *Batrachichnus* sp., *Camunipes cassinisi*, *Dromopus didactylus, Dromopus lacertoides*, *Ichniotherium cottae*, and *Varanopus curvidactylus*.

This last paper ignores the studies of Haubold and Lucas (2001, 2003) which invalidated *Camunipes cassinisi* Ceoloni et al., 1987, considering it a junior synonim of *Erpetopus willistoni* Moodie, 1929. This was not accepted by italian ichnologists (Santi, 2004, 2007b, Santi & Krieger, 2006).

Orobic Basin

Studies on the Early Permian ichnofauna of another important continental italian basin, the Orobic Basin (Pizzo del Diavolo Fm., i.e. Collio Fm. auct.) began with Dozy (1935), who studied two slabs coming from the Val Brembana site, in the locality known as "Bocchetta Podavit".

He instituted two new ichnospecies: *Anhomoiichnium orobicum* and *Onychichnium escheri*. These ichnotaxa were invalidated by Haubold (1971), who considered *Onychchnium escheri* as "incertae sedis" and Haubold (1996) who considered *Anhomoiichnium orobicum* a junior synonim of *Batrachichnus salamandroides* (Geinitz, 1861).

Fossil footprints from this site were described by Santi (1999) and Santi & Krieger (2001). They studied new material from three different localities and identified these ichnotaxa: cf. *Amphisauropus imminutus*, *Amphisauropus latus*, *Batrachichnus salamandroides*, cf. *Batrachichnus salamandroides*, *Dromopus lacertoides*, ?*Ichniotherium* sp., *Varanopus curvidactylus*. Later, Confortini et al. (2001) and Ronchi et al. (2005), identified several new specimens as *Camunipes cassinisi*. In the latter work, a detailed stratigraphic study on a key section with the help of fossil footprints was tempted.

Fossil footprints were noticed and figured by Casati & Gnaccolini (1967) from the Val di Scioc site, in the locality known as "Piani dell' Avaro" (W Orobic basin, Pizzo del Diavolo Fm.). Later this material was classified by Ceoloni et al. (1987) as *Camunipes cassinisi*. New material from this site (from a new locality) was described in a thesis dissertation by Toniutti (1985) and published by Arduini et al. (2003). The latter identified: *Camunipes cassinisi*, *Amphisauropus latus* and *Dromopus lacertoides*.

Ceoloni et al. (1987) studied some specimens found by Casati in the locality known as "Rifugio F.A.L.C." , near the Inferno Lake (Val Gerola site, W Orobic basin, Pizzo del Diavolo Fm.), identifying *Amphisauropus latus*, *Amphisauropus imminutus*, *Laoporus* and Lepidosauria indet. New material from this site was studied by Cassinis et al. (1998), Santi & Krieger (1999), Nicosia et al. (2000) and Gianotti et al. (2001). These ichnotaxa were identified: *Amphisauropus latus*, *Amphisauropus imminutus*, *Dromopus lacertoides* and *Varanopus curvidactylus*. Tracks previously attributed to *Laoporus dolloi* were considered *Amphisauropus* undertracks. The poorness of the fauna was explained with the hypothesis of "deposition time compression": the time of deposition of sediments was too brief to permit the establishment of a larger fauna (Nicosia et al., 2000).

This association was considered similar but stratigraphically higher than those of "Lower Collio" in the Collio basin (Collio Fm., Trompia Valley) and later, by Ronchi & Santi (2003), also younger than those of "Black Collio" of the Orobic Basin (Pizzo del Diavolo Fm., Val Brembana site).

Gianotti et al. (2002), Santi (2005) and Santi & Stoppini (2005) studied few material from the Monte Ponteranica site (W Orobic Basin, Pizzo del Diavolo Fm.), identifying *Amphisauropus imminutus*, *Camunipes cassinisi*, *Camunipes cassinisi* vel *Varanopus curvidactylus*, *Dromopus* sp., and *Varanopus curvidactylus*.

After Santi (2005), the ichnoassociation of the Orobic Basin lists: *Amphisauropus imminutus*, *Amphisauropus latus*, *Batrachichnus salamandroides*, *Camunipes cassinisi*, *Dromopus lacertoides*, *Varanopus curvidactylus*.

Athesian District

The fossil footprints coming from the sedimentary units of the Volcanic Athesian Complex are few and have been only recently studied. Footprints from the Tregiovo Fm. (Tregiovo Basin, Athesian Complex) were classified as *Dromopus didactylus* (Conti et al., 1997, Neri et al., 1999, Avanzini et al., 2001), the Tregiovo association lists only this taxon, so it was considered a "monotypical association" with an important stratigraphic value, because all the ichnotaxa from the Collio and Orobic Basins, slightly younger than the Tregiovo (from radiometric datings, Schlatteger & Brack, 2007, Avanzini et al., 2007), were apparently extinct. The material coming from the Monte Luco Basin (Monte Luco epiclastic units, Athesian Complex) was studied by Avanzini et al. (2008, 2011). These ichnotaxa were recognized: *Amphisauropus latus*, *Batrachichnus* sp., ?*Camunipes*, *Dromopus didactylus*, *Dromopus lacertoides*, *Varanopus* sp. The ichnoassociation was considered transitional between those of Collio and Orobic Basins and that of Tregiovo Basin, the age is in fact intermediate (from radiometric datings Schlatteger & Brack, 2007, Avanzini et al., 2007).

The ichnoassociation

Works regarding the stratigraphic value of the ichnoassociation are several: Conti et al. (1997) and Ronchi & Santi (2005) tempted a reconstruction of FO and LO of the ichnotaxa in two significative, thick and continuous sections of the Collio and Orobic Basins, respectively. Conti et al. (1997) and Avanzini et al. (2001) proposed the use of the "ichnofaunal units", association of imprints with stratigraphic value, and for the Southern Alps the "Collio FU", divided in "Pulpito" and "Tregiovo" sub-units. Cassinis & Santi (2005) compared, from a stratigraphical point of view, the Italian ichnoassociation to those of Europe.
The paleoenvironmental significance was studied instead by Ronchi & Santi (2003).
Other studies regard the behavior of the trackmakers (Santi, 2005, Santi & Stoppini, 2005, Bernardi & Avanzini, 2011, and Petti et al., 2011), ichnotaxonomical problems (Santi, 2004, Santi & Krieger, 2006, and Santi, 2007b), the value of vertebrate ichnofacies (Santi & Nicosia, 2008, Santi, 2008, 2008b). These latter, introduced by Lucas & Hunt (2006, 2007), were considered affected by too many problems to be utilized in a useful way. The italian ichnoceonosis was considered part of

the Batrachichnus ichnofacies, divided in Amphisauropus sub-ichnoceonosis (in Collio and Orobic Basins) and Ichniotherium sub-ichnoceonosis (in Collio Basin).

Despite some problems linked to the difficulty of correlation between continental units and scarcity of well-exposed strata surfaces with footprints, the tetrapod ichnofauna has been well differentiated between the basins, and all data seem to indicate the presence of a reduced (low diversity) ichnofauna in the Southern Alps if compared to Early Permian ichnofaunas of Germany, France and the United States. This was explained by the hypothesis of "deposition time compression" (Nicosia et al., 2000): the time of deposition of sediments in these basins was too brief to permit the establishment of a stable tetrapod fauna.

A further reduction of the ichnoceonosis was observed in younger sediments, with the persistence of the only *Dromopus* in the Tregiovo Basin and in the stratigraphically highest strata of the Collio Basin (Conti et al., 1997; Avanzini et al., 2001). This seems to have all the characteristics of the depletion of a long-living association, with faunal replacement probably linked to environmental changes to more arid conditions (Avanzini et al., 2011b).

Several times italian ichnologists tempted a revision of the Early Permian italian ichnofauna (Conti et al., 1999, 2000, Ronchi & Santi, 2003, Santi 2003, 2005, 2007, Cassinis & Santi, 2005, Nicosia et al., 2005, Avanzini et al. 2011, 2011b). Most of these works simply list the ichnotaxa known from previous publications or add new ichnotaxa without a real description or reference to the material: the result is an incomplete knowledge of the Italian ichnofauna, with data coming from studies done in different periods by different researches, with a different ichnological knowledge, on material coming from different geological settings.

Ultimately, works that treat specifically ichnology and include descriptions and references to the material, are usually "spot works" meant to describe new material coming from a locality or to revise the material of a specific site. Also works that treat stratigraphy and behavior of the trackmakers are limited to single stratigraphic sections or specific slabs. In addition, most of the material has never been described and published, so it is difficult to estimate the real value of the italian ichnoassociation, in respect to the coeval associations.

In this panorama, it is clear that the overview on the italian Early Permian ichnoassociation is incomplete and fragmentary, as well as the relative stratigraphic, paleoenvironmental and behavioral considerations.

The last data are from Avanzini et al. (2011b) and list these ichnotaxa: *Amphisauropus imminutus*, *Amphisauropus latus*, *Batrachichnus salamandroides*, *Camunipes cassinisi*, *Dromopus didactylus*, *Dromopus lacertoides*, *Ichniotherium cottae*, and *Varanopus curvidactylus*.

After the studies of Haubold and Lucas (2001; 2003) and Santi (2007b), the ichnotaxonomic value of *Camunipes cassinisi* Ceoloni et al., 1987 has been debated; until a careful revision we indicate as *Erpetopus* the specimens previously reported as *C. cassinisi*.

Voigt (2005) concluded that *Amphisauropus latus* and *A. imminutus* are the same expression of a morphological continuum and invalidated these ichnotaxa; this kind of footprint is now known as *Amphisauropus kablikae* (Geinitz & Deichmüller, 1882).

The significance of the *Dromopus* ichnogenus Marsh, 1894, despite the extraordinary abundance of these fossils, is still debated. Gand (1988) proposed a differentiation between the ichnospecies of *Dromopus lacertoides* and *Dromopus didactylus (palmatus)*. These ichnotaxa were also adopted by Italian researchers (Conti et al. 1997, 2000; Santi 2005; Avanzini et al. 2008). The validity of this differentiation was questioned by Haubold et al. (1995), Haubold (2000) and Voigt (2005).

If this separation was accepted, we have to discern *D. lacertoides* and *D. palmatus*. Pending a revision, we refer to the first description (*D. lacertoides* Geinitz, 1861).

4) MATERIAL AND METHODS

The material and the institutes

The specimens analyzed, about 1000, come from the collections of the Natural History Museum "E. Caffi" of Bergamo -MBG, Natural History Museum of Milan - V, Natural History Museum of Morbegno -MSNM, Ecomuseum of Val Gerola -CT, Museum of Sciences of Trento -PDV, Paleontological Museum of University "La Sapienza" of Rome -NS, University of Pavia -UP, (for Orobic Basin); Natural History Museum of Brescia -MBS, Paleontological Museum of University "La Sapienza" of Rome -NS, UR, Museum of Sciences of Trento, MUSE (for Collio Basin); Museum of Sciences of Trento -TRE, Natural History Museum of Bolzano -ML (for Tregiovo and Monte Luco Basins). Some of the specimens have newly been numbered, but in some cases it has not been possible to obtain a definitive labeling, these are: CT, UP, UR, PDV, TRE, ML.
New field work was performed in some historical sites (Val Gerola, Val Brembana, Tregiovo, Monte Luco) and new localities (Pizzo Farno, Val Aperta). The material was labeled with temporary field numbers: LI, SV (Val Gerola), PF (Pizzo Farno), TRE (Tregiovo), LU (Monte Luco), BOS, CLE (Val Aperta). Some specimens were impossible to move or cast, these are named "field specimens" and are labeled: INF (Val Gerola), VS (Val Brembana).
The studied material comprises classic Collio collections known in the literature and specimens never described (especially from the Collio Basin). They come from several research surveys done in different periods by different researchers, they have rarely been located stratigraphically (Conti et al., 1997; Ronchi et al., 2005) and mostly we only know the approximate geographical position.
A revision work was needed, because previous studies were characterized by different aims and methodologies, linked to the "state of the art" about Early Permian ichnology. Different researchers studied specimens from different basins and most of the time correlations were done reporting data of different researches. Moreover, a lot of material has never been studied and published.
For all these reasons, a complete work of revision with new techniques and modern ichnology knowledge, on material coming from all Italian sites, was necessary to understand the stratigraphic, paleoecologic and paleoenvironmental meaning of Early Permian tetrapod ichnofauna of the Southern Alps.
The first results confirmed the main ichnogenera known from the Early Permian of the South Alpine region (*Dromopus, Amphisauropus, Erpetopus, Varanopus, Batrachichnus*), adding *Hyoidichnus bifurcatus* Gilmore, 1927 and *Limnopus heterodactylus* (King, 1845). The occurrence

of *Ichniotherium* is questionable; specimens referred to this ichnogenus are *Amphisauropus* (sp. MBS 283) or traces of doubtful classification (sp. MBG 8830). The preliminary results of this research were published in Marchetti et al. (2013, 2013b).

The ichnological study

The classification of fossil footprints may follow two kinds of approaches: anatomically-based or behavioral. Both are suitable, but a mixture of both should be avoided. The study of fossil tetrapod footprints is typically focusing on the trackmaker's anatomy, and from parameters, measurements of footprints and trackways we try to reconstruct their autopodia and even their complete body.
This excludes features related to behavior (like speed of locomotion, gait, etc.) and also effects due to substrate (grain size, wetness, compactness), stratigraphic level (undertracks and overtracks, see the works of Hitchcock 1858; Allen 1989; Lockley 1991) and size of the trackmaker. These are known as extramorphological effects, as first noticed by Peabody (1948). They blur the anatomically controlled impressions of the trackmaker's autopodia, resulting in different deformations such as elongation, truncation, bifurcation, bending, widening, thinning, non-impression, rotation.
It is essential for ichnotaxonomic studies to recognize extramorphological features because these effects are sometimes so pervasive that they inflate every kind of objective analysis. Also, they cannot be compensated by statistical methods and large samples, respectively (Haubold et al., 1995). As a consequence, an extreme taxa oversplitting took place in former studies, especially in those on Early Permian footprints. A large number of so-called phantom-taxa that were mostly based on extramorphological features, have later been synonymized (Haubold et al., 1995, Haubold 1996, 2000, and Voigt, 2005).
After these considerations, it becomes clear that in a work of systematic ichnology it is very important to recognize the state of preservation of the trace fossils and the influence of the extramorphologies, in order to correctly classify the material. Another important point is to refer to precise rules and conventions, reducing the grade of subjectivity.
The first step of this revision work was a preliminary evaluation of the material, mainly in order to recognize the state of preservation and the ichnologic interest of the specimens, poorly-preserved and unclassifiable material was not considered for systematic studies.
The second step was a correct evaluation of the extramorphologies: only optimally-preserved traces, without features coming from this kind of deformations, and preferably along trackways, were

considered for the measure of the footprint parameters used in ichnosystematics. Trackway parameters were measured when appropriate.

To obtain the most precise interpretative drawings, it has been decided to utilize an integration of traditional and modern techniques. The purpose of this procedure is to minimize the subjectivity grade of the free-hand drawings, which obviously can inflate every successive consideration, and to produce final drawings suitable for the measure of the ichnological parameters.

The traditional methods include: free-hand drawings on transparent films and scaled photos perpendicular to the trampled surface, both in controlled light conditions. The oblique light is the better choice to emphatise details of impressions and casts, but light control is not always possible to obtain (i.e. in the field). New acquisition methods were utilized when it was possible, including photogrammetry and laser scanner techniques.

The products of the acquisitions: 1) free-hand drawings, 2) digital photos, 3) 3D models were integrated in vectorial drawings, obtained with the use of graphic devices (graphic tablet), and adequate software (Adobe Illustrator®). The final drawings were exported in .jpg format and the parameters measured on computer (Adobe Photoshop®, Gimp2®). The data were listed in apposite tables (Word Excel®), suitable for successive statistical elaborations.

The measure of the parameters follows the conventions defined by Leonardi (1987), Gand (1988), Voigt & Haubold (2000), and Platt & Hasiotis (2008). They were divided into: single-footprint parameters, trackway parameters and tail parameters. Some of these parameters are new or revised, in this case a clear and precise definition is given.

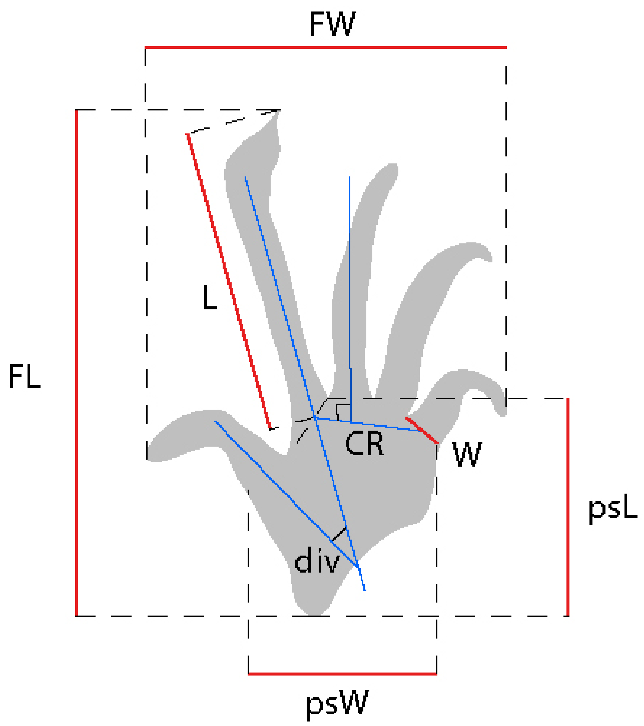

FIG 2: Single-footprint parameters.

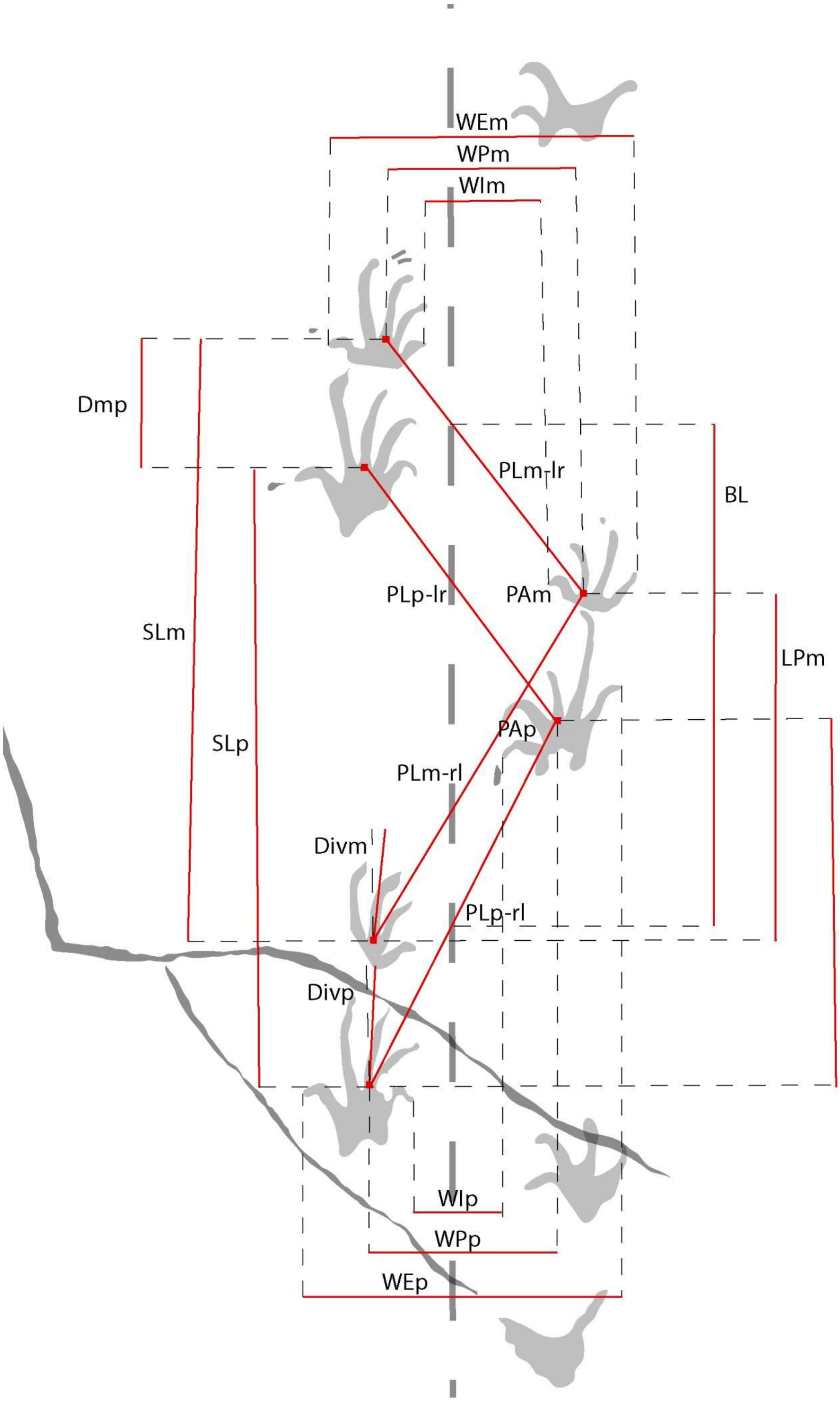

FIG 3. Trackway parameters.

SINGLE-FOOTPRINT PARAMETERS

Footprint length (FL): The distance between the most anterior point and the most posterior point of the footprint, measured parallel to the long axis of the footprint.
Footprint width (FW): The distance between the furthest medial point and the furthest lateral point of the footprint. It is measured parallel to the transverse axis of the footprint.
Cross-axis angle (CR): The angle is defined as the angle between the metapodial-phalangeal axis (cross axis) and the long axis of the footprint. Of the four angles formed by these two axis, the cross-axis angle is the lateral and anterior one.
Palm/sole length (psL): The distance between the furthest anterior and the furthest posterior points of the palm/sole, measured parallel to the long axis of the footprint.
Palm/sole width (psW): The distance between the furthest lateral and the furthest medial points of the palm/sole, measured parallel to the transverse axis of the footprint.
Free length (L): This refers to the measure (taken along the digit axis) of the segment that joins the distal extremity of the digit to the mid-point of the distance between two adjacent hypex.
Basal digit width (W): New measure. The width of the digit, transverse to the digit axis, taken in the most proximal part of the digit (from the anterior hypex, when present).
Divarication of digits (div): The angle between two digit axes on the same autopodium of the same footprint.

TRACKWAY PARAMETERS

Stride (SL): From an ichnological point of view, a stride is the measure of the segment that unites two corresponding reference points of two consecutive footprints on the same side.
(Oblique) pace (PL): The distance between the impression of the right manus (or right pes) and the left manus (or left pes).
Pace angulation (PA): The angle that is constituted by the segments joining corresponding points of three consecutive footprints of the pes (or of the manus).
Pace (LP): The distance that separates two corresponding reference points in two consecutive footprints of a left pes and a right pes (or left manus and right manus), projected upon the midline.
Width of pace (WP): The distance between the mid-points of two consecutive footprints of two hands (or two feet) of the opposite side, projected upon an axis perpendicular to the midline.
Intermanus or interpedes distance (WI): The measure of the distance between the internal (medial) parallel tangents to two consecutive left-right footprints of either the hand or the foot.

External trackway width (WE): The total width, i.e. the distance between the exterior tangents to the footprints, taken parallel to the midline.
Distance between manus and pes (Dmp): The distance between the projections upon the midline of the centers of the autopodia of a set. In this case, the reference points must be the mid-points.
Locomotor efficiency (LE): New measure. It estimates the efficiency of the locomotion. It is higher when manus-pes couples are well-separated and with pes close to manus, in a clear alternating arrangement. It is slightly different from the locomotor efficiency described by Voigt & Haubold (2000). They correlated the manus to the pes of the successive couple on the opposite side, relating it to the distance between the manus and pes. This causes some problems because it correlates different objects and could give negative values. We calculate it relating the mid-points of two consecutive manus-pes couples on opposite sides to the distance between the manus and the pes. LE=(LPp+LPm)/2Dmp.
Body length (gleno-acetabular distance) (BL): It can be considered that the body length is, above the midline, the segment that unites the intersection points of the line of the reference points of the hands (the segment that joins homologous points in two successive fore-footprints of the opposite side) and the line of the reference points of the feet with the midline.
Divarication of foot from midline (DIV): This is the convex angle formed by the longitudinal axis of the foot with the midline. negative values refers to external rotations.

TAIL PARAMETERS

Tail trace width (TW): The width of the tail trace is the distance between the lateral margins of the trace, excluding expulsion rims, measured perpendicularly to the long axes of the trace.
Tail trace midline (Tml): Tail trace midline is the line connecting all the points that are equidistant from the lateral margins of the tail trace.
Tail trace baseline (Tbl): A baseline is established by first drawing tangents to each crest of the tail trace midline and then connecting the intersections of the tangents on each side of the midline; this will create two lines that bracket the tail trace. The baseline is the line equidistant between these two lines.
Wavelength (Twl): Wavelength is used to refer to the distance between two crests or troughs on an individual tail trace. The distance among every three nodes is measured to determine tail trace wavelength because sinuous tail traces are not perfect waves.
Tail trace amplitude (Tam): The maximum distance between tail trace baseline and midline in each crest or trough.

Tail trace sinuosity (TS): To calculate tail trace sinuosity, divide total tail trace length, measured along the midline, by the length of the corresponding tail trace baseline. The result is a dimensionless number that will always be ≥ 1 - the larger the number, the more sinuous the tail trace.

Percent of interruption metric (PIM): Tail traces can be viewed in terms of continuity relative to the total length of the tail trace. This can be quantified by calculating the percent of interruption metric. $PIM = 100(y-\Sigma x_n)/y$. y=total length of the trace, x=length of the segments, n=number of segments. Ideally, PIM represents tail motion in the vertical plane but can vary as a result of preservational factors. This must be taken into account when interpreting the amount of tail motion represented by a tail trace.

The 3D acquisition

In recent years, the 3D acquisition techniques have largely been developed, procedures and instruments are cheaper and easier to utilize than in the past, and the results are more convincing. These procedures allow to obtain 3D models from actual objects and surfaces, which are possible to analyze with appropriate software. This is why some of these methods were adopted also in archeological and geological studies. In paleoichnology, some recent works emphasize the advantages of the laser scanner and digital photogrammetry techniques (Petti et al., 2008, Remondino et al., 2010), especially for the study of dinosaur traces, usually difficult to survey with traditional methods. The advantages include: 1) survey of trampled surfaces impossible to study on the field, 2) preservation of surfaces exposed to weathering effects in a digital form, 3) possibility to directly measure the ichnological parameters on the 3D models, reducing the subjectivity of drawings, 4) possibility to share the 3D models between researches, constructing 3D model databases. They also underlined the preliminary status of these researches and the necessity to still adopt the traditional techniques of the paleoichnology.

Digital photogrammetry and close-range laser scanner methods were tested on some significative specimens from the Early Permian of the Southern Alps, and also on an Early Permian specimen coming from Germany and stored at the University of Pavia.

The objectives were: 1) testing the precision of the techniques in the case of small footprints (< 20 mm) and specimens with low relief, 2) measuring parameters not estimable from drawings, like the depth of the impression, 3) reducing the subjectivity of the final drawings, and 4) testing the portability and the feasibility of these methods.

TRIANGULATION-BASED LASER SCANNER

Laser scanners are active sensors, which project a laser beam on the studied object and register the reflected signal, reconstructing a three-dimensional model. The triangulation-based laser scanners work on close ranges (250-900 mm) and in conditions of scarce illumination, so they are suitable for the study of relatively small specimens in close spaces. They project a laser beam on the specimen, which reflects the beam, and the returning signal is registered by a CCD camera. The system created by the projecting and the returning beam form a triangle, defined by two angles. The source of light can project a point, a stripe or a rectangle, depending on the instrument.
This method was tested on some significant specimens stored at Natural History Museum of Brescia, they come from the Val Trompia and Val Caffaro sites (Collio Basin, Collio Fm.). The specimens analyzed are: MBS 277, 281, 283, 310, 311, 317, 318, 319, 325, 326.

DIGITAL PHOTOGRAMMETRY

Photogrammetric techniques are based on 2D images acquired by passive sensors (photos from digital cameras), utilizing the natural or artificial light from a source different from the sensor, and reflected by the studied object. These methods permit to reconstruct the geometric relationship between the object and the camera at the time of acquisition, with the parallaxes principles. Some photos of the same object are required, from different points of view. All the points of the object present on different photos are defined (homologous points), and permit to obtain the original position of the camera respect to the object, and the 3D coordinates of the points themselves. These are finally utilized to construct a 3D model of the object, which has to be scaled.
The specimens analyzed are: UP 19, ICHNIO, UR 93, NS 43-159, MUSE 7086, CT 2. Usually a calibration of the camera is needed, but it was chosen to utilize the most time-saving and cheapest procedure.

5) SYSTEMATIC ICHNOLOGY

Ichnogenus: *Amphisauropus* Haubold, 1970

Ichnospecies: *Amphisauropus kablikae* (Geinitz & Deichmüller, 1882)

Material: CT 2, CT 3, CT 4, CT 5, INF 3/NS 43-3, INF 4, INF 5, INF 9, LI 16, LI 21, MSNM 28, MSNM 30, MSNM 32, MSNM 35, MSNM 36, PDVcII 3, PF 6, MBG 8827, MBG 8829, MBG 8954, MBG 12454, MBG 12455, MBG 12529, MBG 12533, VS 5, MBS 118, MBS 268/269, MBS 279, MBS 281, MBS 283, NS 43-100, NS 43-248, NS 43-249, CURIONI, UR 7, UR 9, UR 126, UR 180, MUSE 7086, ML2 2, LUdt 9.

DESCRIPTION

Quadrupedal, fully plantigrade tracks of a tetrapod of small to medium size.

Pes: Pentadactyl, slightly longer than wide (foot length 11-74 mm, average 36 mm; foot width 11-69 mm, average 34 mm, FL/FW 1.1, on average). The functional prevalence is medial, the basal pad of the digit I is strongly impressed. The digits are wide and straight, with rounded enlarged tips, and increase in length from I to IV (the length of digit IV is 4-45 mm, average 17 mm). Digit proportions: I<V<II<III<IV, the digit V is frequently not impressed. The digit width decreases from digit I to V. The digits diverge radially from the palm, the digit I is in a proximal position (Cross-axis angle of 60°). The digit divergence is regular (I-II 18°, II-III 18°, III-IV 26°, IV-V 31°), the II-IV divergence is 44°, the total divergence is 92°. The sole is well-impressed, rectangular in shape, and long about half of the foot length (sole length 5-38 mm, average 18 mm; sole width 7-51 mm, average 23 mm, FL/psL 2).

Manus: Pentadactyl, smaller than pes, and significantly wider than long (foot length 8-49 mm, average 28 mm; foot width 9-71 mm, average 40 mm, FL/FW 0.7). The functional prevalence is medial, the basal pad of the digit I is strongly impressed. The digits are wide and short, with rounded tips, median digits (II-III) are often distally bent towards the midline. The digit length slightly increases between the digits I-IV (the length of digit IV is 3-29 mm, average 13 mm), the digit V is frequently not impressed. Digit proportions: I<V<II<III<IV. The digit width is regular, and slightly higher in digits I and IV. The digits diverge radially from the palm (Cross-axis angle of

78°). The digit divergence is regular, slightly higher in lateral digits (I-II 27°, II-III 21°, III-IV 28°, IV-V 38°), the II-IV divergence is 49°, the total divergence is 114°. The palm is well-impressed, rectangular in shape, and sensibly wider than long. It is long about half of the foot length (palm length 5-30 mm, average 15 mm; palm width 11-43 mm, average 26 mm, FL/psL 1.9).

Trackway pattern: Trackways are disposed in a regular alternating arrangement of manus-pes couples. The speed of locomotion is slow (stride length of 33-205 and 36-219 mm, average 117 and 121 mm; SL/FL 2-7.5, average 4.36; length of pace of 16-192 mm and 17-120 mm, average 62 mm and 63 mm; for the pes and the manus, respectively). The pace length is slightly lower in the manus, this is consistent with a more internal position of the manus (40-221 and 36-184, average 113 and 103; for the pes and the manus, respectively). There are not significative differences of pace length from left to right and right to left. The pace angulation is low, this reflects a slow gait, and it is slightly higher in the manus, because of its internal disposition (41-105° and 47-108°, average 68° and 77°; in the pes and the manus, respectively). LE is 1.6, on average.

The pes is close to the manus but not overstepping it (manus-pes distance 11-77 mm, average 38 mm). The manus is more internal than the pes (external trackway width 117 and 108 mm, width of pace 92 and 80 mm, interpedes/manus distance 62 and 51 mm; in the pes and the manus, respectively. Values on average). The manus is strongly rotated inwards (divergence of 32°, on average), the pes is parallel to the midline or rotated outwards (divergence of -21°, on average). Apparent body length is 29-157 mm, 92 mm on average. SL/BL is 1.3 on average.

Some specimens show a continue and deep tail impression, in a marked sinusoidal arrangement. They also show marked curved furrows departing from the inner digits of the pes (I-III).

REMARKS

This ichnotaxon is well-represented in the Early Permian of the Southern Alps. Optimally-preserved tracks, complete trackways showing different gaits, sizes and extramorphologies constitute a complete record, which can be considered part of a morphological continuum (Voigt, 2005).

The pes foot length is generally between 30-50 mm, but smaller (sp. MBG 8827, MBS 268/269) and bigger tracks (sp. CURIONI, MBS 283), are also recorded. The average footprint size is smaller in the Orobic Basin. In small-sized trackways the angle between manus and pes reaches its maximum, and the trackway pattern is more irregular (sp. MBG 8827, MBS 283).

The locomotion speed is generally slow, but trackways with higher gaits are also observed. In these cases the pes is aligned to the midline (sp. CT 4, INF 5, INF 9). Slow gaits can be associated with higher manus-pes distance (sp. MBS 268/269), and tail impression.

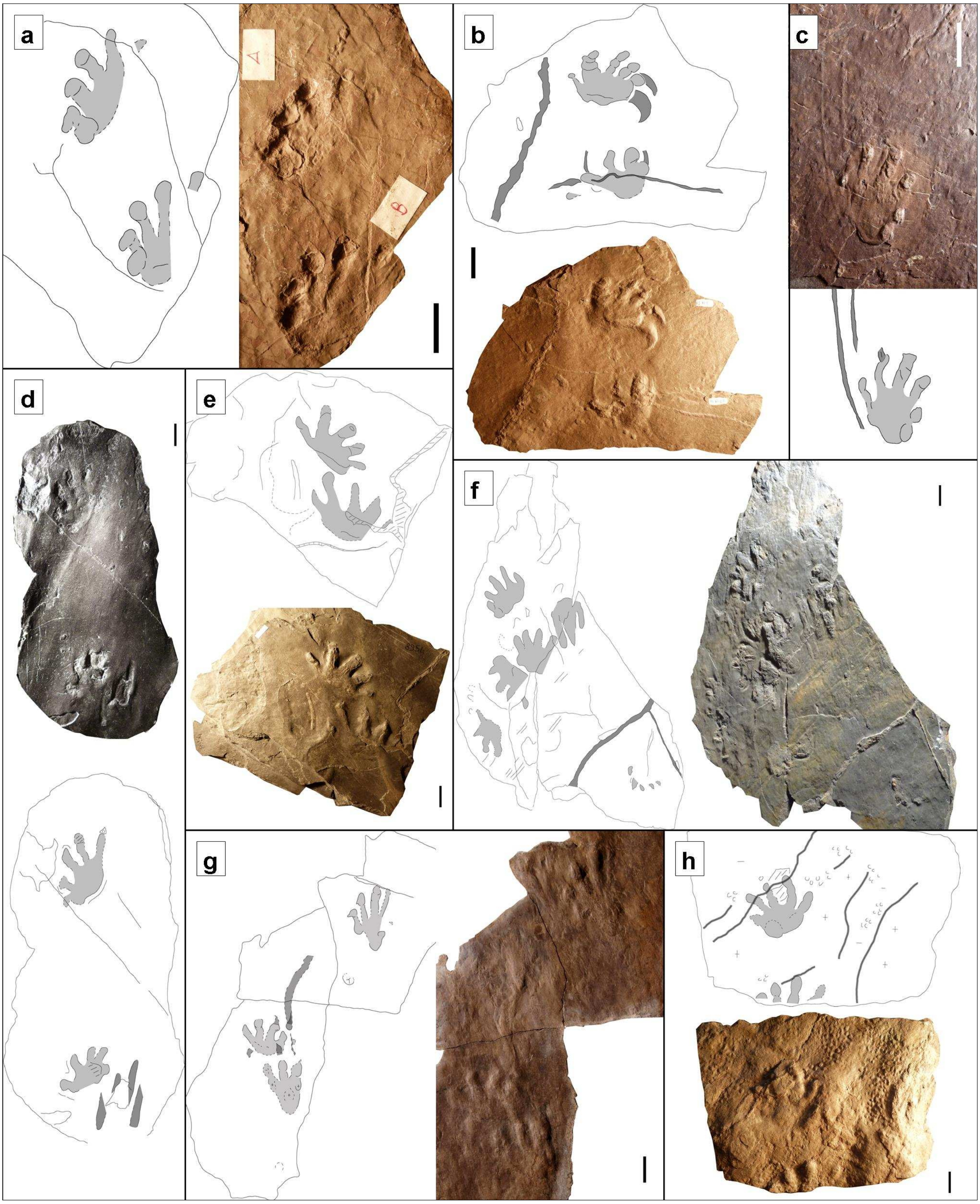

FIG 4. ***Amphisauropus kablikae*****. Footprints and incomplete step cycles. a) Sp. MSNM 32. b) Sp. NS 43-3. c) Sp. CT 5. d) Sp. MBG 12533. e) Sp. MBG 8954. f) Sp. MBG 8829. g) Sp. MBS 283. h) Sp. LUdt 9. Scale bar 20 mm.**

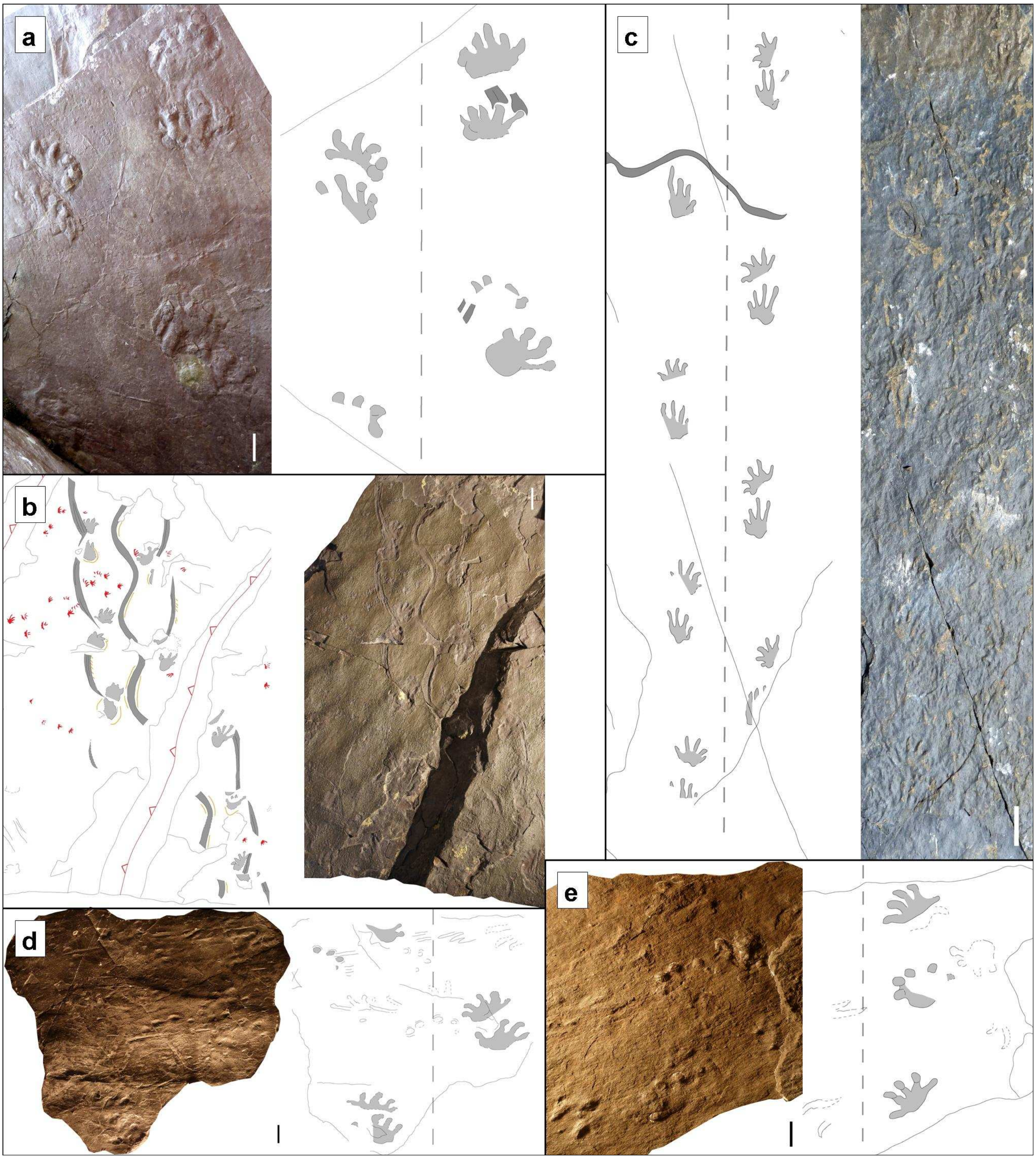

FIG 5. *Amphisauropus kablikae*. Trackways. a) Sp. INF 5. b) Sp. CT 2. c) Sp. INF 9. d) Sp. MBG 12529. e) Sp. UR 126. Scale bar a, c, d, e 20 mm; b 50 mm

Noteworthy are the specimens CT 2 and CT 3, from the Val Gerola site (W Orobic Basin). They show a deep and continuous tail impression, in a perfectly sinusoidal arrangement. Continuous and arcuate digit scratches form the pes medial digits (I-III), are also observed. The marked lateral movement of the tail and the hind limbs suggest a substantial lateral movement of the body during the locomotion, the continuity and the constant width of the tail point to scarce vertical motion. This is different from tail traces documented in the Early Permian, slightly sinuous or straight (Gand, 1988, Haubold et al., 1995, Haubold, 1996, Lucas et al., 2005, and Voigt et al., 2013). This kind of impression is reported for the first time for *Amphisauropus*, commonly not associated with tail trace (the only similar record is from Van Allen, 2005).
The specimen MUSE 7086 (Val Aperta, E Collio Basin) shows an optimally-preserved *Amphisauropus* trackway parallel to two *Erpetopus* trackways, this could testify parallel locomotion of the trackmakers (Marchetti et al., 2013).
The extramorphologies include: medial sliding of the digit I (sp. INF 3/NS 43-3), undertrack effects (impressions with acuminate digits, *Laoporus*-like) and scratches probably linked to subaqueous movement (sp. CT 1, CT 4, MSNM 28, MSNM 35, MSNM 36, NS 43-1, MBG 12533).

DISCUSSION

The ichnogenus *Amphisauropus* was instituted by Haubold (1970), who described the two ichnospecies *Amphisauropus latus* and *A. imminutus* from the red beds of Germany. This distinction was based on differences in imprint size (*A. latus* is the bigger one), width of pes, intradigital angles and position of axis of manus and pes (Voigt, 2005). After studies on extensive material from Germany, Voigt (2005) concluded that these two ichnospecies represent footprints of the same animal in different ontogenetic phases, and are thus the expressions of a morphological continuum. The ichnospecies *A. latus* and *A. imminutus* were both invalidated and the ichnospecies name *A. kablikae* was restored for priority reasons (from *Saurichnites kablikae*, described by Geinitz & Deichmüller, 1882). The material from the Southern Alps displays a complete range of trackway patterns, track sizes, extramorphologies and optimally-preserved tracks. The study on the track and trackway parameters confirms the hypothesis of a morphological continuum from small (<20 mm) to large (>70 mm) *Amphisauropus* traces, thus the presence of the sole ichnospecies *A. kablikae* is here confirmed. Further studies are needed to establish if the *Amphisauropus* tracks with sinusoidal tail impression (sp. CT 2, CT 3), could constitute a new ichnospecies.
This ichnotaxon is well known from the Italian Permian basins (Ceoloni et al., 1987, Nicosia et al., 2000, Santi & Krieger, 2001, Avanzini et al., 2008, and Marchetti et al., 2013). Our material is

comparable to the specimens described from New Mexico (Lucas et al., 2001), Nova Scotia (Van Allen et al., 2005), Morocco (Voigt et al., 2011) and Poland (Voigt et al., 2012), although the continuous and peculiar arrangement of tail impression and claw marks observed in specimens CT 2 and CT 3 from W Orobic Basin are a unique feature (the only similar report is from Nova Scotia; Van Allen et al., 2005). The trackmakers were seymouriamorphs (Haubold, 1971, 2000, Lucas et al., 2001, Van Allen et al., 2005, and Voigt, 2005), like *Seymouria* (Van Allen et al., 2005).

Ichnogenus: *Batrachichnus* Woodworth, 1900

Ichnospecies: *Batrachichnus salamandroides* (Geinitz, 1861)

Material: V 7052, PDVcII 4, PDVcII 7, PDVcII 10, MBG 8831, MBG 8842, MBG 10115, MBG 10118, MBG 12456, MBG 12460, MBG 12464, MBG 12500, MBG 12502, MBG 12523, VS 6, MBS 268/269, MBS 323, MBS 326, NS 43-103, NS 43-150/158, ML1 7, ML2 1.

DESCRIPTION

Quadrupedal, fully plantigrade tracks of a tetrapod of small size.

Pes: Pentadactyl, longer than wide (foot length 6-18 mm, 12 mm on average; foot width 7-23 mm, 12 mm on average, FL/FW 1.1, on average). The functional prevalence is medial. The digits are wide and straight, with rounded tips, and increase in length from I to IV (the length of digit IV is 6 mm, on average), the digit V is frequently not impressed. Digit proportions: V<I<II<IV<III. The digit width is higher in medial digits. The digits diverge radially from the palm, the digit I is in a proximal position (Cross-axis angle of 63°). The digit divergence is low and regular in the medial digits (I-II 22°, II-III 27°, III-IV 36°, IV-V 64°, II-IV 59°, I-V 148°). The sole is well-impressed, U-shaped, and long about half of the foot length (sole length 6 mm; sole width 7 mm, FL/psL 2. Values on average).

Manus: Tetradactyl, smaller than pes, and slightly wider than long (foot length 6-16 mm, average 10 mm; foot width 5-14 mm, average 9 mm, FL/FW 1.1, on average). The functional prevalence is medial. The digits are straight, wide and short, with rounded tips. The digit length slightly increases between the digits I-III (the length of digit III is 5 mm, on average). Digit proportions: I<IV<II<III. The digit width is regular, and slightly higher in digit III. The digits diverge radially from the palm

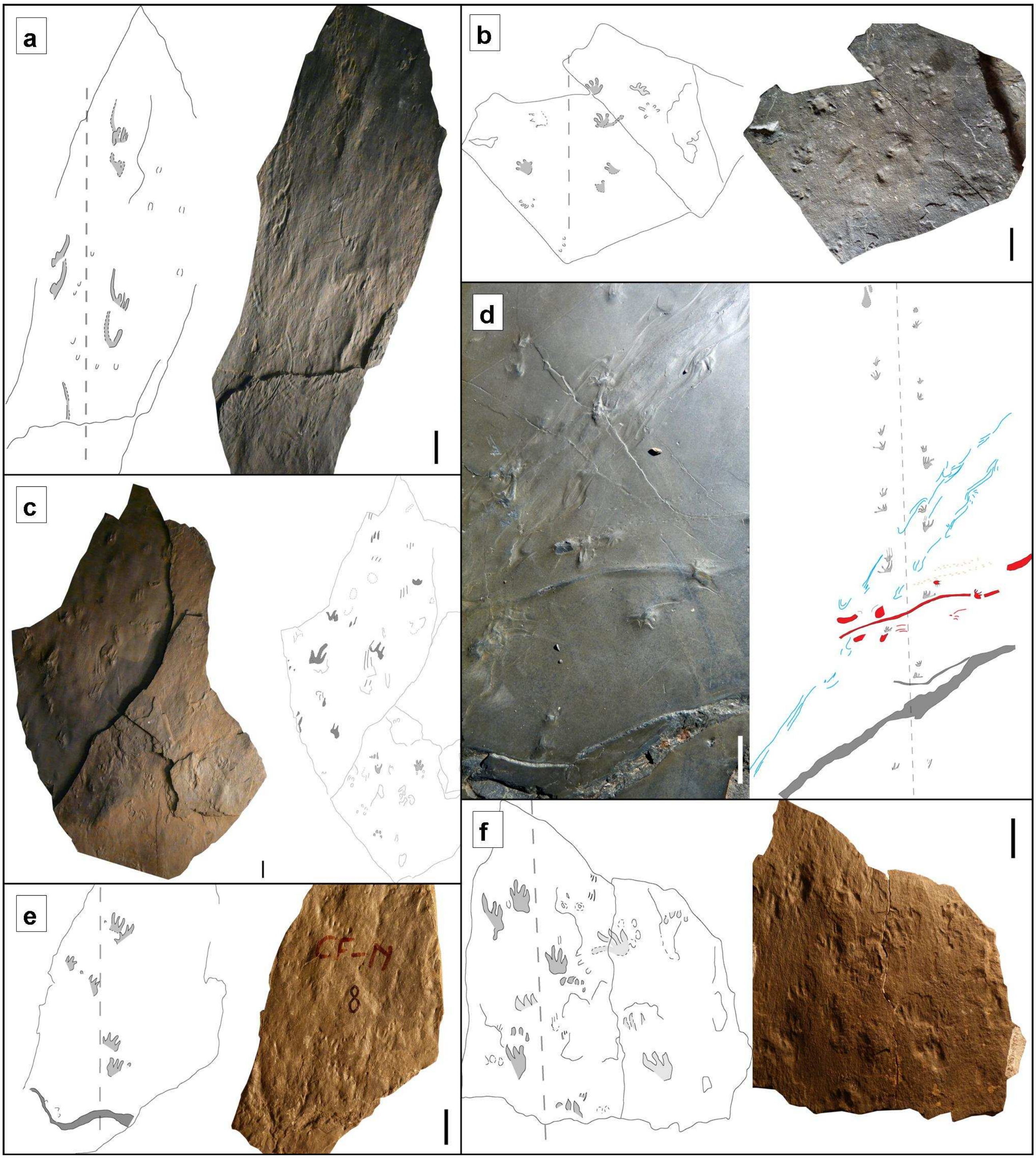

FIG 6. ***Batrachichnus salamandroides*. Footprints and trackways. a) Sp. PDVcII 4. b) Sp. V 7052. c) Sp. PDVcII 7. d) Sp. VS 6. e) sp. MBS 10921. f) sp. NS 43-158. Scale bar 20 mm.**

(Cross-axis angle of 80°, on average). The digit divergence is regular, and slightly higher in lateral digits (I-II 28°, II-III 17°, III-IV 28°), the II-IV divergence is 47°, the total divergence is 78°. The palm is well-impressed, U-shaped, and sensibly wider than long. It is long about half of the foot length (palm length 5 mm, palm width 7 mm, FL/psL 2. Values on average).

Trackway pattern: Trackways are usually disposed in a regular alternating arrangement of manus-pes couples, or in a less distinguished pattern, especially at slow gaits. The speed of locomotion is slow to moderate (stride length of 37-112 and 33-105 mm, average 76 and 77 mm; SL/FL 3.4-7.8, average 6.3; length of pace of 8-78 mm and 12-73 mm, average 38 and 39 mm; for the pes and the manus, respectively). The pace length is 29-86 mm and 20-84 mm, average 57 and 56 mm; for the pes and the manus, respectively. There are not significative differences from left-to-right and right-to-left, and between manus and pes. The pace angulation is medium, this reflects a moderate gait (45-124° and 65-115°, average 85° and 87°; in the pes and the manus, respectively). LE is 1.8, on average. The pes is variably close to the manus and not overstepping it (manus-pes distance 6-50 mm, average 21 mm). The manus is directly in front of the pes (external trackway width 52 and 47 mm, width of pace 40 and 39 mm, interpedes/manus distance 30 and 28 mm; in the pes and the manus, respectively. Values on average). The manus is parallel to the midline or slightly rotated inwards (manus divergence of 3°, on average), the pes is parallel to the midline or rotated outwards (pes divergence of -20°, on average). Apparent body length is 34-100 mm, average 62 mm. SL/BL is 1.3, on average. Tail and belly drags, when present, are deep-impressed, continuous, and slightly sinuous.

REMARKS

This ichnotaxa is quite rare in the Southern Alps. Optimally-preserved material, showing anatonomically-controlled features, is scarce (sp. MBS 268/269, NS 43-150/158). Extramorphologies, undertracks and swimming traces linked to this ichnotaxa are very diffuse, and indicate a wet substrate. Three different preservational styles can be distinguished, as hypothesized by Petti et al. (2011): 1) tracks impressed on wet substrate, 2) tracks impressed on water-saturated substrate, 3) tracks impressed on extremely wet substrate or underwater.

Type 1 is characterized by plantigrade to semi-digitigrade impressions, which can preserve the anatonomycal details of the track, be deformed (sp. MBG 10115, MBG 11523, VS 6, MBS 323, MBS 326, NS 43-103), or impressed in a *Chelichnus*-like morphology (sp. MBG 8831, MBG 10118, MBG 12500, PDVcII 10). Type 2 includes ovoid-shaped tracks, with elongated or grouped digits, they generally show a deep and continuous tail impression, slightly sinusoidal (sp. PDVcII 4, VS 6, MBS 326). Type 3 is characterized by long, thin and arcuate digit scratches departing from the digits, the original footprint shape is not recognizable (sp. MBG 12502, VS 6). In some cases, scratches are short, grouped and separated from each other, this seem to indicate subaqueous gait (sp. MBG 12460, PDVcII 7, VS 6, ML1 7, ML2 1).

The specimen VS 6 shows several long and continuous trackways with a transition between the different morphotypes. The intersection between the trackways permits a correct reconstruction of the events, emphasizing a transition between the track types 1, 2 and 3, passing from an extremely wet-substrate to dryer conditions. The trackway E shows a passage from plantigrade tracks to aligned scratches, with a progressively lower pace angulation and higher trackway width. This was interpreted as a transition of the trackmaker from terrestrial to submerged conditions (Petti et al., 2011). The specimen MBS 326 shows two long plantigrade trackways, with large and deep tail impressions, crossing each other in the central part of the slab. The substrate was evidentely water-saturated, because tracks have an ovoid shape and digits, when present, are grouped or elongated. Trackway 2 exibits low pace angulation, high manus-pes distance, high trackway width, completely-deformed tracks and impression of the belly. This suggests a difficult and slow locomotion in an extremely wet substrate. Trackway 2 is successive, and shows an higher pace angulation, a regular alternating arrangement of manus-pes couples, and a sinuous tail impression. This suggests a faster locomotion in slightly dryer conditions.

DISCUSSION

The ichnogenus *Batrachichnus* was introduced by Woodworth (1900), the two ichnospecies described for the Early Permian are traditionally *B. salamandroides* (Geinitz, 1861) for the European specimens and *B. delicatulus* (Lull, 1918) for the North American material. After the revision of Haubold et al. (1995) and Haubold (1996; 2000) it became clear that the separation between these ichnospecies was inconsistent, thus *B. salamandroides* (Geinitz, 1861) is the valid name for priority reasons. This ichnotaxon has been reported in Italy by Ceoloni et al. (1987) as *Gracilichnium berrutii* (i.e. *Batrachichnus* undertrack, sp. MBS 323), Santi and Krieger (2001), Avanzini et al. (2008), Petti et al. (2011). The studied material is characterized by a typical undertrack preservation, the optimally-preserved specimens are few. The extramorphologies are caused by the interaction of this type of trackmakers (amphibians) with muddy and inconsistent substrate in a wet environment, rather than by the small dimensions (Haubold et al., 1995, Haubold, 1996). Continuous tail impressions, belly traces (sp. MBS 326), digit scratches and swimming traces (sp. ML1 7, ML2 1) are common, the specimen in situ described by Petti et al. (2011) shows a transition between terrestrial and submerged locomotion (sp. VS 6; Valsecca, Val Brembana site). The trackmakers were probably small temnospondyls, i,e. juvanile Eryopids (Haubold et al., 1995, Melchor & Sarjeant, 2004) or branchiosaurids/micromelerpetondids (Gand, 1988, Gand & Durand, 2006).

Ichnogenus: *Dromopus* Marsh, 1894

Ichnospecies: *Dromopus lacertoides* (Geinitz, 1861)

Material: CT 3, CT 4, CT 7, INF 6, LI 4, LI 14, LI 17, LI 18, LI 19, LI 20, MSNM 27, SV 13-25, SV 13-28, UP 13, UP 14, PG 16, PDVcII 1, PDVcII 5, PDVcII 6, MBG 12452, MBG 12466, MBS 258-259, MBS 278, MBS 307, MBS 310, MBS 311, MBS 321, MBS 325, MBS 326, MBS 10917, MBS 11025, MBS 11053, NS 43-111, NS 43-118, NS 43-128, NS 43-137, NS 43-155, NS 43-216, UR 8, UR 29, UR 55, UR 65, UR 122, UR 141, UR 192, BOS1 2, BOS 1 3, TRE 5, TRE 9, TRE 101, TRE 160, TRE 171, LU 1, LUdt 8, LUdt 14, ML1 11, ML2 7, ML3 1, ML3 2, ML5 6.

DESCRIPTION

Quadrupedal, semidigitigrade to digitigrade imprints of a tetrapod small- to medium- sized.
Pes: Pentadactyl, sensibly longer than wide (foot length 16-68 mm, average 34 mm; foot width 8-55 mm, average 23 mm, FL/FW 1.5, on average). The functional prevalence is lateral, the digits III-V are more commonly impressed. The digits are long and slender, with a falcate shape, and end in claws. They strongly increase in length from I to IV (digit IV is by far the longest, and measures 5-45 mm, 18 mm on average), and are curved towards the midline, the digit V is straight, in a proximal-lateral position, and directed outwards. The digit I is frequently not impressed, the digit V is usually present as small tip. Digit proportions: I<II<V<III<IV. The digit width is regular, around 3 mm. The digits diverge radially from the palm, and are in a progressively more distal position, from I to IV (Cross-axis angle of 58°).
The digit divergence is smaller between median digits, higher between medial digits and very high between lateral digits (I-II 35°, II-III 22°, III-IV 27°, IV-V 75°), the II-IV divergence is 50°, the total divergence is high, 166°. The sole, usually not impressed, is triangular in shape and it is long about 2/5 of the foot length (sole length 6-30 mm, average 13 mm; sole width 6-23 mm, average 12 mm, FL/psL 2.5, on average).

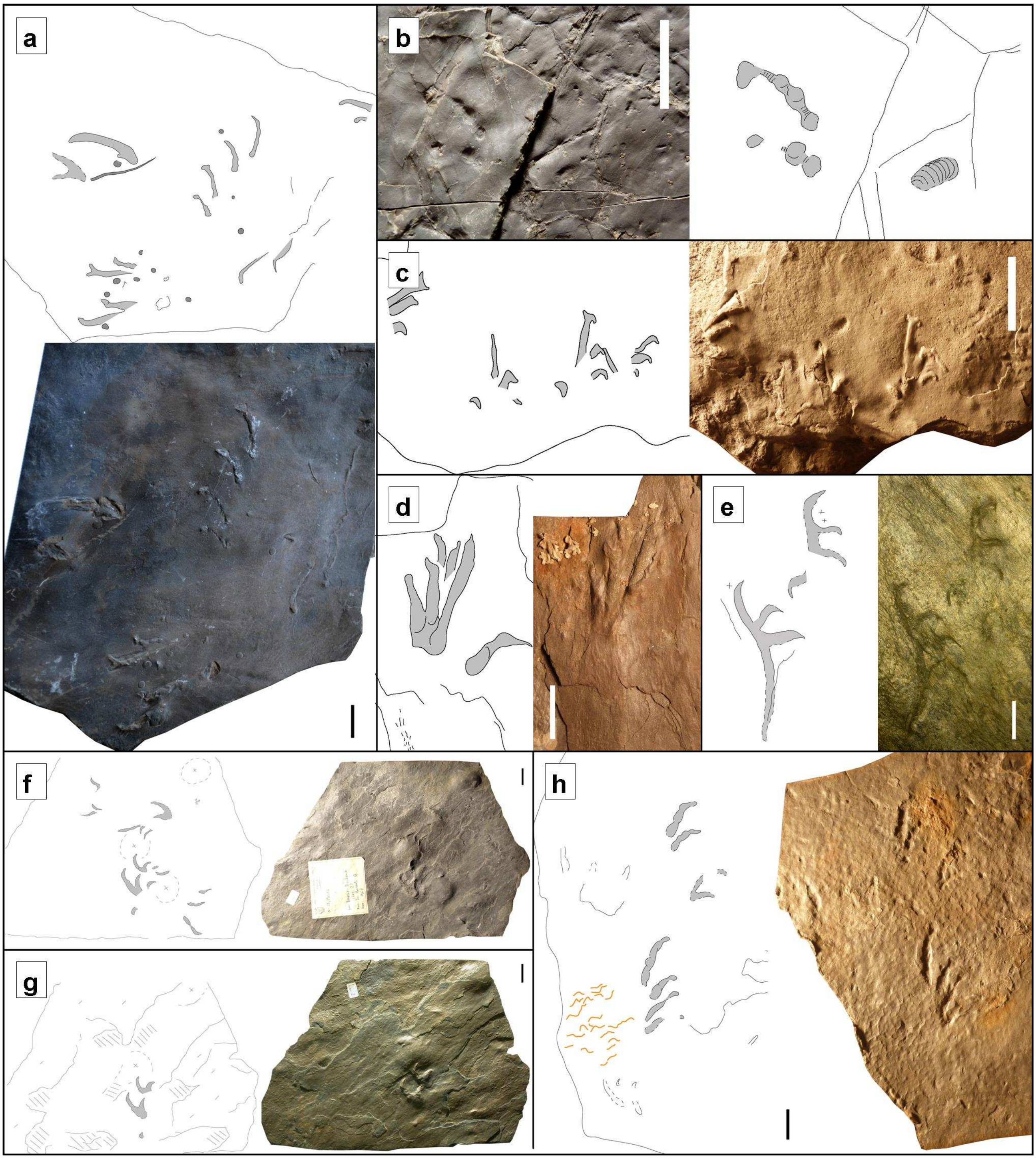

FIG 7. ***Dromopus lacertoides*****. Tracks and incomplete step cycles. a) Sp. PG 16. b) Sp. LI 14. c) Sp. SV 13-25. d) Sp. UR 29. e) Sp. MBS 311. f-g) Sp. MBS 325. h) Sp. NS 43-216. Scale bar 20 mm.**

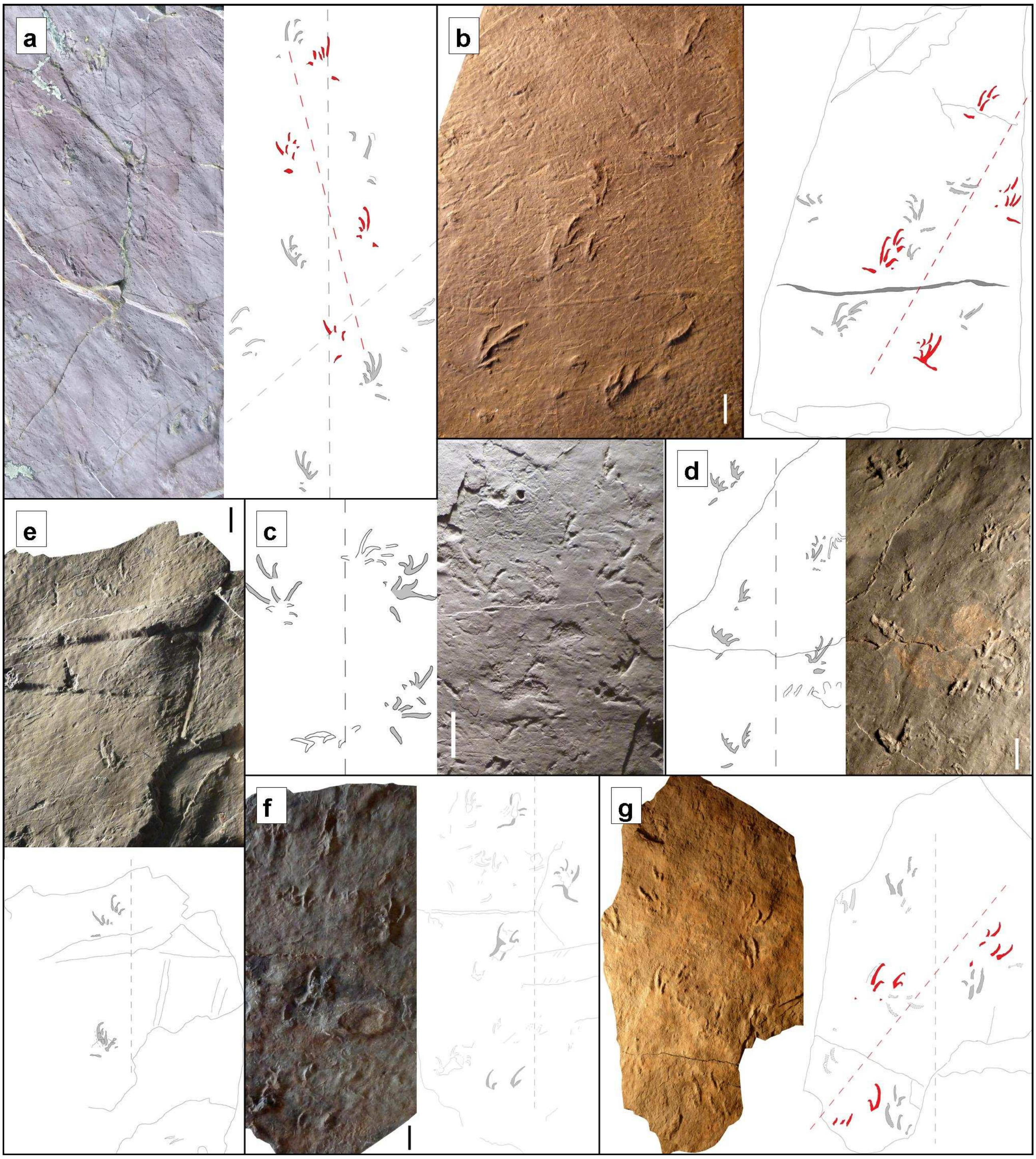

FIG 8. *Dromopus lacertoides.* Trackways. a) Sp. INF 6. b) Sp. UP 13. c) Sp. CT 4. d) Sp. CT 3. e) Sp. MBG 12466. f) Sp. NS 43-111. g) Sp. UR 8. Scale bar b, c, d, e 20 mm; a, f, g 50 mm

Manus: Pentadactyl, smaller than pes, and significantly longer than wide (foot length 9-63 mm, average 24 mm; foot width 6-50 mm, average 18 mm, FL/FW 1.5, on average). The functional prevalence is lateral, digits III-IV are more commonly impressed. The digits are long and slender, with a falcate shape, and end in claws. They strongly increase in length from I to IV (digit IV is by far the longest, and measures 4-33 mm, 15 mm on average), and are curved towards the midline, the digit V is straight, in a medial-lateral position, and directed outwards. The digit I is frequently not impressed, the digit V is usually present as small tip. Digit proportions: I<II<V<III<IV. The digit width is regular, around 2 mm. The digits diverge radially from the palm, and are in a progressively more distal position from I to IV (Cross-axis angle of 58°).

The digit divergence is smaller between median digits, higher between medial digits and very high between lateral digits (I-II 36°, II-III 28°, III-IV 31°, IV-V 101°), the II-IV divergence is 59°, the total divergence is high, 174°. The palm, usually not impressed, is triangular in shape and it is long about 2/5 of the foot length (palm length 6-17 mm, average 10 mm; palm width 4-16 mm, average 9 mm, FL/psL 2.6, on average).

Trackway pattern: Trackways are disposed in an alternating arrangement of manus-pes couples, often strongly overlapping. The speed of locomotion is very variable, from slow to fast (stride length of 53-326 and 50-317 mm, average 166 and 167 mm; SL/FL 2-5-10.4, average 5.1; length of pace of 5-212 mm and 4-227 mm, average 83 and 92 mm; for the pes and the manus, respectively). The pace length is slightly lower in the manus, this is consistent with a more internal position of the manus, and is higher from right to left (106 mm from left to right; 127 and 123 mm from right to left, for the pes and the manus, respectively. Values on average).

The pace angulation is low to high, reflecting differences in gait. It is higher in the manus, because of its internal disposition (44-131° and 38-142°, average 92° and 100°; in the pes and the manus, respectively). LE is 6.6, on average.

The pes is close to the manus and often overstepping it (manus-pes distance 0-81 mm, average 18 mm). The manus is more internal than the pes (external trackway width 98 and 76 mm, width of pace 75 and 63 mm, interpedes/manus distance 58 and 50 mm; in the pes and the manus, respectively. Values on average). The manus is rotated inwards (manus divergence of 23°, on average), the pes is parallel to the midline (pes divergence of -2°, on average). Apparent body length is 38-209 mm, average 101 mm. SL/BL 1.7 mm, on average.

REMARKS

This ichnotaxon represents the most common form in the Early Permian of the Southern Alps. The marked digitigrady, the overstepping of the pes on the manus, the undertrack effects and the densely-trampled surfaces are very frequent, and most of the times hampers a correct ichnotaxonomy. Optimally-preserved tracks and relatively-long and complete trackways, in a clear pattern, are observable in the Orobic Basin (Val Gerola site, sp. CT 3, CT 4, INF 6, UP 13).

The extramorphologies include: grouping of the digits, undertrack effects, and digit tips bifurcation. In the first case a superimposition of the digits II-IV is observable, this forms an apparent plantigrade impression with the only curved terminations of the digits II-IV recognizable (sp. CT 3, INF 6, MBS 311, UR 65). In the specimen CT 3 this feature appears in the last portion of a long trackway with optimally-preserved tracks, so it is clearly an extramorphology. This was classified as *Dromopus lacertoides* in the basal part of Collio Fm. (sp. MBS 311, UR 65), and differentiated from the more digitigrade forms of the upper Collio Fm., classified as *D. dydactylus*, by Conti et al. (1999).

In some cases, it is possible to observe the same impression on different layers (undertracks). The specimen MBS 325 shows an almost complete manus-pes couple, with the pes digits II-V and the manus digits I-IV. The same impression is preserved in the underlying layer: it is larger, with shorter digits and displays only the pes digits III-V and the manus digits III-IV. The pes digit V is preserved as a small tip. Specimen MBS 310 shows a superimposed manus-pes couple, which appears a single impression in the overlying layer. The digit tip bifurcation is observed in the digits III and IV (sp. LI 19, SV 13-25, PG 16).

Some specimens in a good preservation state, preserve the digit pads (sp. LI 14, PDVcII 6, NS 43-128, NS 43-216, UR 192, TRE 160, ML 3, ML5 6). In the sp. LI 14, the preservation is so fine that enables to recognize the scaly skin impression. Some flat thin scales are preserved between the pads of the digits III and IV, and some larger curved scales appears in the digit V impression, with triangular terminations of the lateral scales on the margins.

The gait of this ichnotaxon is generally fast, but some variability is observed. In trackways with slow locomotion speed, both the pes and the manus are outwards-oriented (sp. CT 4, trackway 4). In cases of very fast gaits, the pes can be parallel to the midline or inwards-oriented (sp. INF 6, trackways 2, 3, 4, 5).

DISCUSSION

This ichnotaxon represents the most common type track of the Early Permian. It was introduced by Marsh (1894) as *Dromopus agilis*, the first description is instead from Geinitz (1861), *Saurichnites*

lacertoides. Some authors support the validity of *Dromopus palmatus* Moodie, 1929 (also known as *D. dydactylus*), basing on the distance between the bases of the digits III or IV and the tip of digit V (Gand & Haubold, 1984, Gand, 1988, and Gand & Durand, 2006). This is clearly an unsuitable parameter, because it is strongly influenced by the digitigrady degree of the impression, it seems more linked to the preservational conditions than to an evolutionary meaning. This is also the case of the Italian material, the specimens from the Collio and Tregiovo Basins are characterized by a marked digitigrady (sp. UR 8), up to only two pes digits; instead those from the Orobic and Monte Luco Basins are more complete (sp. MBG 12466) and smaller in size. This is why previous studies supported the hypothesis of the occurence of both *Dromopus lacertoides* and *D. dydactylus* in Italy (Ceoloni et al., 1987, Nicosia et al., 2000, Santi & Krieger, 2001, Santi & Stoppini, 2005, and Avanzini et al., 2008). The study of the Italian material shows a complete range of preservational styles, extramorphologies, gaits and sizes related to this ichnotaxon. The study of track and trackway parameters from the best-preserved material, and a correct evaluation of the extramorphlogies, confirm the presence of the only ichnospecies *Dromopus lacertoides*.
The trackmakers were probably areoscelids (Haubold, 1971, Gand, 1988, Haubold et al., 1995, Haubold, 2000, Haubold & Lucas, 2001, 2003, Voigt, 2005, and Gand & Durand, 2006), eosuchia (Gand, 1988, Gand & Durand, 2006) or bolosaurids (Voigt, 2005).

Ichnogenus: *Erpetopus* Moodie, 1929

Material: CT 2, MSNM 27, NS 43-5, SV 13-28b, NS 43-8, V 2856, V 7006, V 7007, V 7010, V 7012, V 7013, V 7014, V 7024, V 7029, V 7033, V 7039, V 7040, V 7042, V 7043, V 7059, V 7061, V 7062, V 7063, V 7064, V 7065, V 7072, V 7073, V 7076, V 7077, MUSE 5721, PDVcII 13, PDVcII 16, PF 8, MBG 8848, MBG 10108-10132, MBG 10117, MBG 12465, MBG 12479, MBG 12480, MBG 12489, MBG 12490, MBG 12494, MBG 12519, MBG 12520/VS 4, MBG 12523, VS 7, MBS 281, MBS 319, NS 43-104b, NS 43-311, UR 6, UR 66, UR 128, UR 140, UR 187, MUSE 7086, ML2 8.

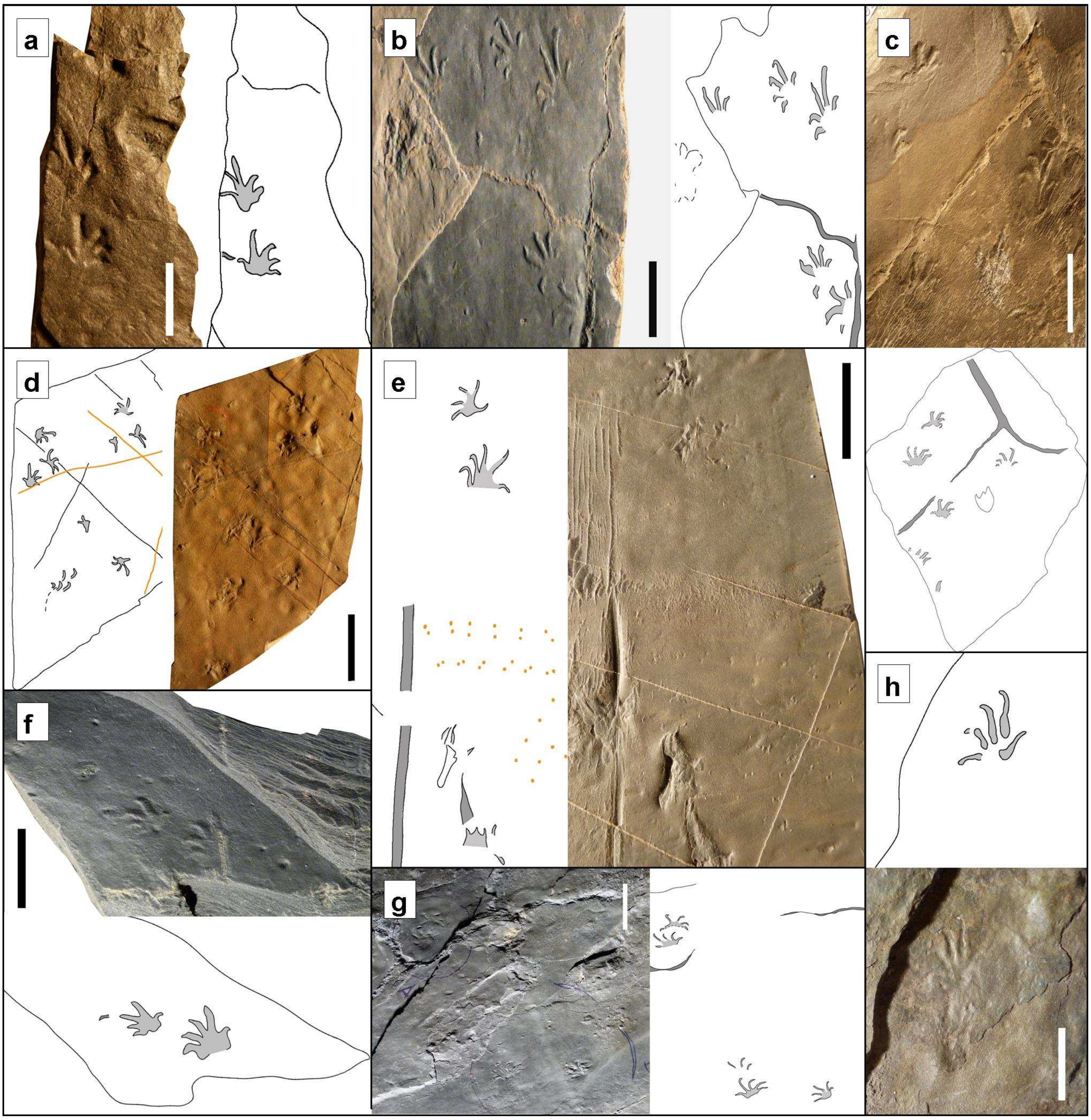

FIG 9. ***Erpetopus.*** **Tracks and fragments of trackway. a) Sp. NS 43-8. b) Sp. PDVcII 13. c) Sp. MBG 12519. d) Sp. V 7059. e) Sp. MBG 10117. f) Sp. MBG 12494. g) Sp. MBG 12479. h) Sp. UR 187. Scale bar 20 mm.**

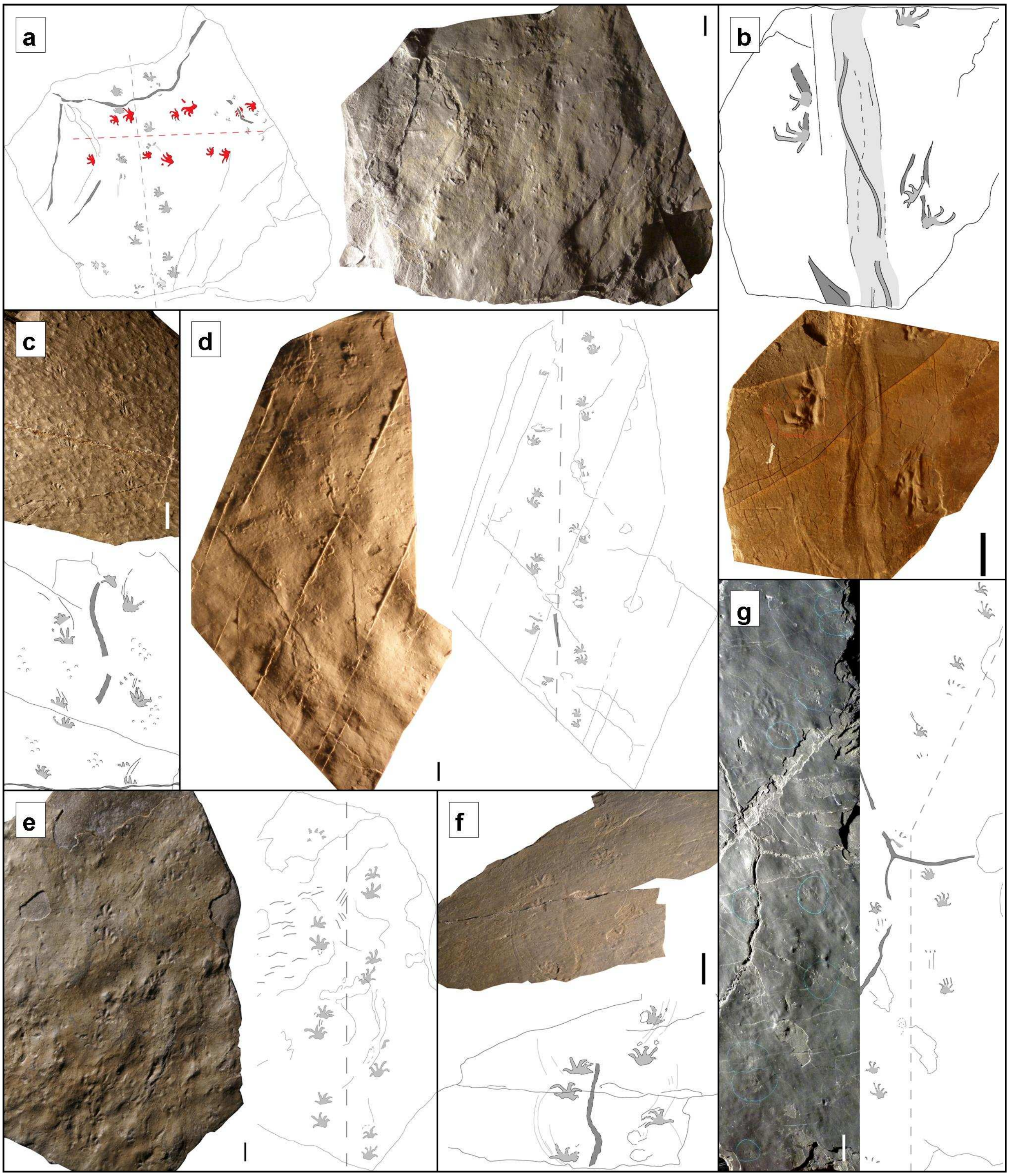

FIG 10. ***Erpetopus*** **trackways. a) Sp. V 2856. b) Sp. V 7072. c) Sp. MBG 8848. d) Sp. MBG 12520. e) Sp. MBS 319. f) Sp. PDVcII 16. g) MBG 12480. Scale bar 20 mm.**

DESCRIPTION

Tracks of a small quadruped, with pentadactyl pes and manus impressions.

Pes: The pes is pentadactyl, plantigrade to semi-digitigrade and less impressed than the manus. It is usually as long as wide (foot length 5-29 mm, foot width 4-21 mm, average of 11 and 12 mm, respectively FL/FW is 0.9, on average). Digits are thin, long and straight and end in claws, the distal part of the digits I-IV is typically curved inwards. The digit length increases between the digits I and IV (length of digit IV 3-17 mm, average 6 mm), the digit V is in a proximal position and directed outwards. It is sub-equal in length with the digits I and II. In the second case, it may appear curved backwards. A median-lateral decrease in relief is common, and causes a reduced impression of the digits IV and V, this latter is commonly preserved as a tip. Digit proportions: I<V<II<III<IV. Digit width is around 1-2 mm and is higher in lateral digits.

The digits diverge radially from the palm (Cross axis angle of 70°). The divergence between median digits is small (II-III 24°, III-IV 28°), slightly higher between medial digits (32°) and strongly variable between lateral digits (IV-V 46°). The II-IV divergence is 52°, the total divergence is 135°. Values on average. The sole, if preserved, is rectangular. It represents almost half of the pes length (sole length 2-14 mm, average 5 mm; sole width 2-12 mm, average 7 mm), psL/FL is 2.3, on average.

Manus: The manus is pentadactyl, plantigrade to semi-digitigrade and slightly smaller than the pes. It is slightly wider than long (foot length 3-15 mm, average 9 mm; foot width 4-18 mm, average 10 mm, FW/FL 0.9, on average). The digits are thin, straight and end in claws, the distal part of digits I-IV is typically curved inward. The digit length slightly increases between digits I and IV (length of the digit IV 2-12 mm, 5 mm on average), the digit V is shorter, as long as digit I and laterally directed. In digitigrade imprints, only the distal portions of the digits are preserved, commonly those of digits I-IV. Digit proportions: I<V<II<III<IV.

The digit width is around 1-2 mm, it is higher in the lateral digits. The digits diverge radially from the palm (Cross axis angle of 76°). The digit divergence is smaller between median digits (II-III 31°, III-IV 30°), and higher in the outer digits (I-II 41°, IV-V 59°). The II-IV divergence is 62° and the total divergence is 163°. These values are defenitely higher than the pes. The palm is short and rectangular and constitutes almost half of the foot length (palm length 1-9 mm, average 4 mm; palm with 2-12 mm, average 6 mm), psL/FL is 2.4.

Trackway pattern: The trackway pattern shows an alternating arrangement of manus-pes couples, which can be irregular, especially in small imprints.

The speed of locomotion is very variable, from slow to fast (stride length of 24-110 mm and 23-130 mm, average 65 and 63 mm; SL/FL 2.8-10.7, 6.4 on average; length of pace of -8-69 mm and 0-67 mm, average 32 mm; for the pes and the manus, respectively).
The pace length is lower in the manus, this is consistent with its more internal position, and can be strongly asymmetrical (50 mm for the pes, 44 mm for the manus. Values on average). The pace angulation is low to high, reflecting differences in gait. It is higher in the manus, because of its internal disposition (21-121° and 28-150°, average 84° and 96°; in the pes and the manus, respectively). LE is 2.47, on average.
The manus is positioned close to the pes, and in some cases a slightly overstep is observable (manus-pes distance 3-39 mm, 14 mm on average). Compared with the pes, the manus is positioned more close to the midline (external trackway width 46 and 38 mm, width of pace 35 and 28 mm, interpedes/manus distance 25 and 19 mm; in the pes and the manus, respectively. Values on average). The orientation of the pes is parallel to the midline or slightly rotated inward or outward (pes divarication 0° , on average) the manus is directed inward (manus divarication 23°, on average). The apparent body length is 19-93 mm, average 45 mm. SL/BL is 1.5, on average.

REMARKS

This ichnotaxon is very abundant in the Southern Alps, especially in the Orobic Basin, where is often the predominant form. The quantity of material permits to reconstruct a complete record of gaits, track sizes and extramorphologies. Long and complete trackways in a good- to optimal-preservation are quite common, and permit ichnotaxonomical studies.
Some specimens show a relatively-long pes digit V (about as digit II), which is proximally-positioned, and with high IV-V divergences (about 50° or more). These features are observed in trackways with different sizes, locomotion speeds and preservation states, and appear to be continuous along the trackways, so they are probably the expression of a specific morphotipe or ichnospecies, rather than an extramorphological trait (sp. CT 2, MSNM 27 trackway 2, V 2856 trackway 1, V 7008, V 7012, MBG 12465 Trackways 1, 3, 4, MBG 12480, MBS 319, NS 43-311, UR 128, MUSE 7086 trackways 1, 2). Some specimens exhibit a reduced pes digit V (shorter than digit I), which is forward-oriented and close to the digit IV (low IV-V divergence). This is clearly an extramorphological trait, probably linked to the substrate wetness, since the digit is abnormally short and its shape is not defined (sp. V 7006, V 7040, V 7042, V 7059, V 7063, V 7073, MBG 8848, MBG 12465 trackway 5, MBG 12520/VS 4, VS 7). An apparent transition between the two morphologies, it is observed in the specimens PDVcII 13 and MBG 10117.

The footprints are usually as long as wide in the pes and slightly wider than long in the manus, but some specimens exhibit wider pes impressions (sp. V 2856 trackway 3, MBG 12465 trackway 3). Peculiar anvil-shaped footprints, clear extramorphologic traits, are observed in two different trackways (sp. NS 43-104b, NS 43-311).

The trackways are disposed in a typical alternating arrangement of manus-pes couples, usually asymmetrical, with the pes close to the manus. The gait is moderate to fast, but some specimens exhibit a particularly slow locomotion, probably linked to the substrate wetness (sp. MBG 12465 first trait of trackway 3, MBS 281). The trackway pattern is usually slightly- to moderately-irregular, in small-sized specimens it can be very irregular (sp. V 7029, V 7073, UR 5).

Tail impressions associated to *Erpetopus* are relatively common, and can be divided in slightly-sinuous and perfectly-straight traces. The first are generally associated with moderate locomotion rates (sp. MSNM 27, V 7072, PDVcII 16, MBG 8848, MBG 10118/10132, VS 7, NS 43-311, UR 140), the second with much higher speeds (sp. NS 43-5, MUSE 5721, PF 8, MBG 10117, MDS 7086). These impressions are usually discontinuous, but only in one case their pattern is regular, and thus gait-controlled (sp. MTSN 5721). In some cases, it is also observable the body impression, the substrate was probably very wet, as testified by tracks extramorphologies (sp. V 7072).

Traces associated to submerged locomotion, in some cases disposed along trackways, are often associated to this ichnotaxon (sp. MBG 10108-10132, PF8, MUSE 7086). In the specimen V 7039, it is observable a passage between plantigrade locomotion to this kind of scratches, this constitute an evidence of subaqueous locomotion of the *Erpetopus* trackmaker.

DISCUSSION

The ichnogenus was introduced by Moodie (1929) from the study of some specimens of the Choza Formation in Castle Peak (Texas). This material was later revised by Sarjeant (1971), Haubold (1971), Haubold & Lucas (2001, 2003). In this last work the ichnospecies *Microsauropus clarki* Moodie 1929, *M. acutipes* Moodie 1929, *M. parvus* Moodie 1930, *M. orthodactylus* Moodie 1930 (Texas), *Camunipes cassinisi* Ceoloni et al. 1987 and *Gracilichnium berrutii* Ceoloni et al. 1987 (Italy) and some specimens previously classified as *Varanopus curvidactylus* from the French Basins (Ellenberger, 1983, Gand & Haubold, 1984, Gand, 1988, 1993, and Demathieu et al., 1991) were invalidated and considered synonyms of *E. willistoni*.

This was not accepted by Gand & Durand (2006), they considered valid the ichnospecies *Microsauropus acutipes* and utilized it for the French specimens. Santi (2007b) didn't accept the inclusion of the Italian *Camunipes cassinisi* in *Erpetopus willistoni*, proposing at least a coexistence of two ichnospecies in the ichnogenus *Erpetopus*. The Italian material clearly pertains to the same ichnogenus, i.e. *Erpetopus* Moodie, 1929. Some specimens show peculiar features (i.e. the different length and disposition of the pes digit V), which seem to indicate that the separation of the two ichnospecies *E. willistoni* Moodie, 1929 and *E. cassinisi* (Ceoloni et al., 1987) could be justified (Marchetti et al., 2012). The study of a complete series of trackways, with different gaits, track size, preservation state, from the Italian material allows some considerations: the traits which can be related to a different ichnotaxon (i. e. *Erpetopus cassinisi*), are not controlled by the extramorphologies, thus constitute at least a new *Erpetopus* morphotype. The comparison with the holotypes and the material from Castle Peak and to French and Moroccoan specimens is necessary to establish definitely a new ichnospecies.

Erpetopus in Italy has often been reported as *C. cassinisi* (Berruti et al., 1969, Ceoloni et al., 1987, Santi & Krieger, 2001, Gianotti et al., 2002, Arduini et al., 2003, Ronchi et al., 2005, Santi, 2007b, Bernardi & Avanzini, 2011, Marchetti et al., 2012, 2013). The trackmakers were small captorhinids (Haubold, 1971, Ceoloni et al., 1987, Haubold, 2000, Haubold & Lucas, 2001, 2003, and Voigt et al., 2013) or protorothyridids (Haubold & Lucas, 2001, 2003, and Bernardi & Avanzini, 2011).

Ichnogenus: *Hyloidichnus* Gilmore, 1927

Ichnospecies: *Hyloidichnus bifurcatus* Gilmore, 1927

Material: CT 6, LI 9, LI 10, MSNM 32, MSNM 33, UP 7, PG 11, V 7053, V 7054, V 7055, MBG 12529, MBG 12531, MBG 12532, MBS 260, MBS 268-269, MBS 274, MBS 10973, TRE 161, UR 80, UR 93, UR 95

DESCRIPTION

Quadrupedal, semiplantigrade-digitigrade tracks of a tetrapod of medium size.

Pes: pentadactyl, longer than wide (foot length 26-62 mm, average 45 mm; foot width 27-69 mm, average 44 mm, FL/FW 1.1, on average). The digits are straight, long and slender, with a rigid aspect. Digit length increases from I to IV (length of digit IV 15-44 mm, 29 mm on average), the digit V is long about as II and set back, and it may be absent. Digit proportions: I<V<II<III<IV.

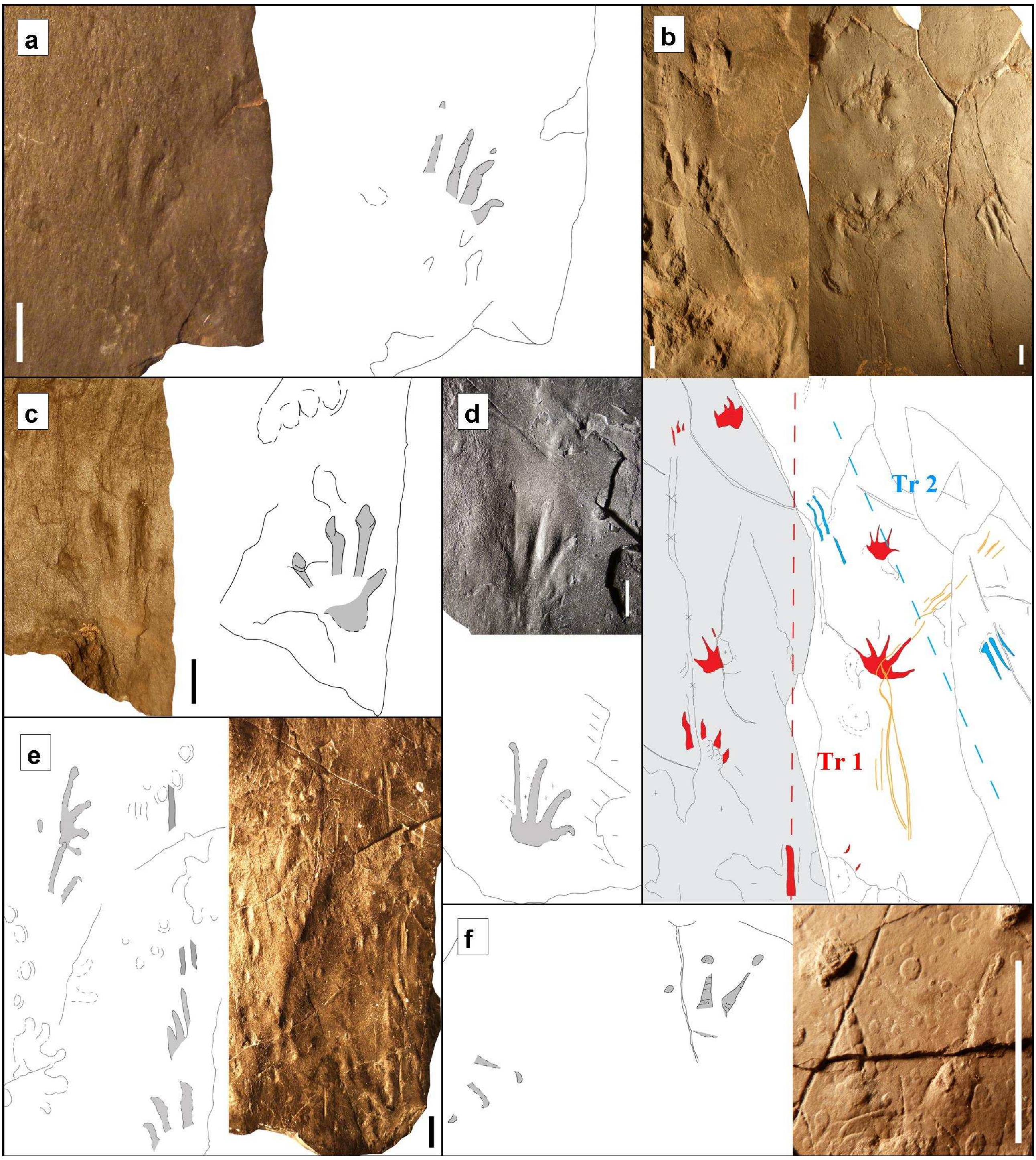

FIG 11. ***Hyloidichnus bifurcatus.*** **Tracks and trackways from Collio Basin (a-c) and Orobic Basin (d-f). a) Left pes with impression of claws, sp. UR 80. b) Tracks similar to *Gilmoreichnus (Hylopus) hermitanus* (Gilmore, 1927). Tr1=semiplantigrade trackway, Tr2=swimming traces. Sp. UR 93-MBS 274. c) Right pes, bended claw impressions of digits II-III and short digit V, sp. MBS 10973. d) Left pes with short palm impression, in situ cast, sp. MBG 12531. e) Two manus-pes couples along a trackway, in situ cast, sp. MBG 12529. f) Left manus imprint with scaly skin impression and raindrops, natural cast, sp. MSNM 32. Scale bar 20 mm.**

The digit width is regular, and around 5 mm. Digits usually terminate with an enlarged tip, claws are often curved or bifurcated. The digits depart radially from the palm (Cross axis angle of 72°, on average). Low divergence between central digits (divergence II-III 24°, III-IV 19°, II-IV 39°), higher in the external ones (I-II 39°, IV-V 37°), total divergence 139°, values on average. Short and rectangular sole pad when present, long about as 2/5 of the foot length. (Sole length 11-27 mm, average 18 mm; sole width 12-39 mm, average 26 mm; psL/FL 2.5, on average).
Manus: pentadactyl, smaller than pes, about as long as wide (foot length 23-46 mm, average 35 mm; foot width 28-56 mm, average 40 mm; FL/FW 0.9, on average). The digits are straight, long and slender, increasing in length from I to IV (length of digit IV 10-24 mm, average 19 mm), V frequently not impressed. Digit proportions: I<V<II<III<IV. Digits usually terminate with an enlarged tip. Digit width is regular, and around 4 mm. The digits diverge radially from the palm (Cross axis angle of 71°, on average). Regular divergence between digits (I-II 46°, II-III 29°, III-IV 20°, IV-V 47°, II-IV 48°, I-V 131°, values on average), higher than the pes. Short palm when present, long about as 3/7 of the foot length (palm length 11-21 mm, 15 mm on average; palm width 20-35 mm, 26 mm on average).
Trackway pattern: Trackways are disposed in a regular alternating arrangement of manus-pes couples. The speed of locomotion is quite slow (stride length 323 mm and 301; SL/FL 5.7; length of pace of 150 mm and 144 mm; for the pes and the manus, respectively). The pace length is asymmetrical (left-to-right 210 and 207 mm, right-to-left 239 and 203 mm, for the pes and the manus, respectively). The pace angulation is quite low, this reflects a slow gait (71° in the pes and 85° in the manus). LE is 1.6, on average. The pes is close to the manus and occasionally overstepping it (manus-pes distance 30-124 mm, 70 mm on average). The manus is in front of the pes (external width 205 mm and 171 mm, width of pace 164 mm and 135 mm, interpedes/manus distance 120 and 112 mm; in the pes and the manus, respectively. Values on average). The manus is commonly rotated inwards (manus divergence of 10°), the pes is parallel to the midline or slightly rotated outwards (pes divergence of -3°). The apparent body length is 245 mm, SL/BL is 1.3.

REMARKS

This ichnotaxon is quite rare in the Southern Alps, and until now only manus-pes couples and fragments of trackway are known. One of the typical features of this ichnotaxon is the "rigid aspect" of the central digits II-III-IV; really long and straight. In specimen MSNM 32 it is observable a left manus with digits II-IV impressed, the preservation is so fine that it enables to recognize the scaly skin impression of the lower part of the digits. Termination of the digits is frequently impressed as rounded tips or claws. In specimen MBS 10973 the claws of digits II and III are typically rotated; this kind of feature is common in *Hyloidichnus* and frequently causes the bifurcation of digit tips, this last is observable in specimen LI 10. Other observed characteristics are: a median-lateral decrease of relief, which hampers the preservation of complete lateral digits and palm, and a marked overstepping of the pes on the manus (sp. UP 7).

During the locomotion, the manus is commonly inwards rotated (sp. LI 19, MSNM 33, MBG 12529), but with an higher (PG 11, UR 93/MBS 274) or reduced manus-pes distance (UP 7), the manus appears more aligned with the direction of locomotion.

The specimen UR 93/MBS 274 (trackway 2) shows signs of swimming traces, size and morphology are comparable with this ichnotaxon (two series of parallel scratches, and the best preserved with a length of 33-42 mm, decreasing in width from the top, which is enlarged and with a displacement rim). These marks were produced in submerged conditions; the animal touched the bottom with claws, moving to the upper left part of the specimen. After this passage, water level dropped, permitting an animal of the same kind to produce a regular trackway (trackway 1) with semi-plantigrade imprints and a partial trace of the tail, moving to the top of the specimen. A fragment of the tail mark is present (width 7.5 mm), and it shows a displacement rim. The pes imprint on the right is then passed by an invertebrate trail, which testifies the presence of water.

Similar marks were noted also in specimen UR 95, under the manus imprint. In some cases digits could be longer than normal, and this is an extramorphological effect (digits I-II in specimen UR 95, the overall imprint appears deformed).

DISCUSSION

The ichnogenus *Hyloidichnus* was introduced by Gilmore (1927) from the study of some specimens from the Grand Canyon (USA). The ichnospecies are: *H. bifurcatus* Gilmore, 1927; *H. whitei* Gilmore, 1928; *H. arnhardti* Haubold, 1973; *H. tirolensis* Ceoloni et al. 1986; *H. major* (Heyler & Lessertisseur, 1963) and *H. minor* (Heyler & Lessertisseur, 1963). After the revision of Haubold (2000), only *H. bifurcatus* (USA) and *H. major* (France) were considered valid ichnospecies, although the relationship between these ichnotaxa has not been properly investigated. The Italian material matches the descriptions of Gilmore (1927) and Haubold et al. (1995). The main differences from the ichnogenus *Varanopus* Moodie, 1929 are: 1) the length of the digit V of the pes, about as long as digit II (in *Hyloidichnus*, this material) or digit III (in *Varanopus*); 2) the manus strongly rotated to the midline in *Hyloidichnus* (sp. MBG 12529); 3) the maximum length of footprints, *Varanopus* seems not to exceed 40 mm (these specimens reach 62 mm). Because of the

uncertain relationship between the two valid ichnospecies, it was utilized the first described (*H. bifurcatus* Gilmore, 1927). Some specimens with a peculiar preservation state (UR 93/MBS 274, UR 95) are similar to the ichnotaxon *Gilmoreichnus (Hylopus) hermitanus* (Gilmore, 1927). These specimens resemble semiplantigrade tracks described by Haubold et al. (1995) -fig 18a- and morphotype C, in Swanson & Carlson (2002). Swimming traces are very close to the tracks described by Lucas et al. (2005) -fig 8c- and to morphotype D in Swanson & Carlson (2002). After the considerations of Voigt (2005) and Gand & Durand (2006) the validity of this ichnotaxon is debated. These footprints are probably extramorphological variations of *Hyloidichnus*, because of similar footprints and trackway parameters and the relative length of digit V.
Hyloidichnus has also been reported in the USA (Gilmore, 1927, 1928, Haubold, 1971, Haubold et al., 1995); France (Heyler & Lessertisseur, 1963, Gand, 1988, and Gand & Durand, 2006); Spain (Gand et al., 1997); Morocco (Voigt et al. 2010, 2011); Turkey (Gand et al., 2011) and Argentina (Melchor & Sarjeant, 2004).
The supposed trackmakers were captorhinomorphs (Haubold et al., 1995, Haubold, 2000, Gand, 1988, Gand & Durand, 2006) or large derived captorhinids (i.e. Moradisaurinae clade, Voigt et al., 2010). Some authors related these footprints to diadectids (Haubold, 1971, Haubold et al., 1995).

Ichnogenus: *Limnopus* Marsh, 1894

Ichnospecies: *Limnopus heterodactylus* (King, 1845)

Material: CT 3, INF 8, UP 19, SV 13-29, MBG 12527, MBS 277, MBS 317, MBS 318, MBS 10987, MBS 11054, NS 43-159, NS 43-249, NS 43-273, UR 27, LU1 17.

DESCRIPTION

Quadrupedal, fully plantigrade tracks of an animal of medium size.
Pes: pentadactyl, plantigrade, slightly longer than wide (foot length 15-72 mm, average 36 mm; foot width 10-89 mm, average 33 mm; FL/FW 1.2, on average), with medial apparent functional prevalence (prominent digit I basal pad). The digits are straight, broad, and distally rounded.
The digit length increases from digit I to digit IV (length of digit IV 6-47 mm, average 19 mm), the digit V is not well impressed or absent, and is long about as digit I. Digit proportions:

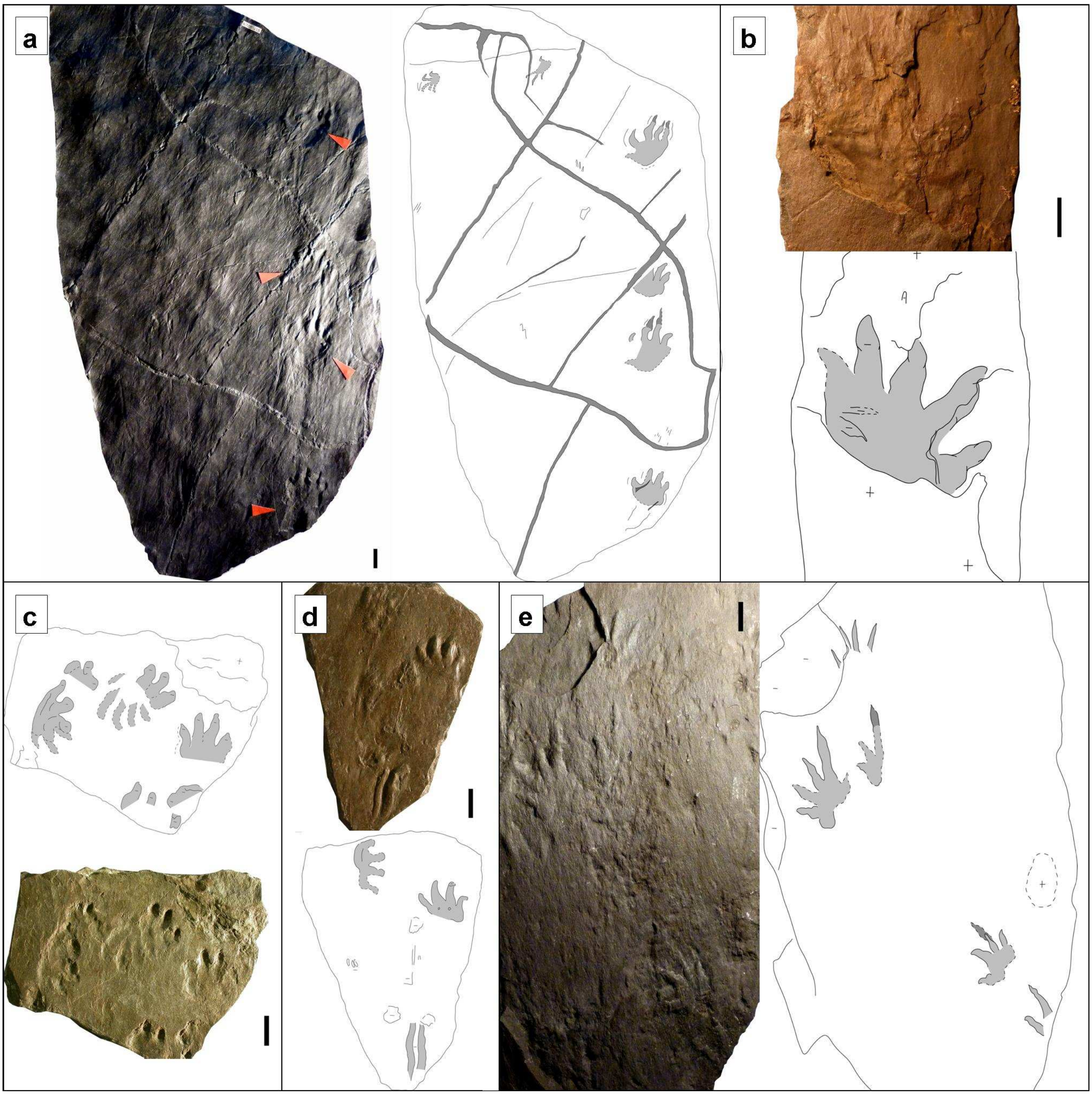

FIG 12. *Limnopus heterodactylus*. Tracks and incomplete step cycles from Collio Basin (b-d) and Orobic Basin (a). a) Left side of a trackway, footprints parallel to the travel direction. In situ cast, sp. MBG 12527. b) Left pes, natural cast, Sp. UR 27. c-d) Specimens collected in 1870 by G.Bruni, previously classified as *Amphisauropus* (Ceoloni et al., 1987). Note the tetradactyl manus. sp. MBS 318 -c- and 317 -d- (natural cast). e) Well-preserved left pes impression and other tracks, natural cast, Sp. UR NS 43-159. Scale bar 20 mm.

I<V<II<III<IV. The digit width is high, and around 5 mm. The digits depart radially from the palm (Cross axis angle of 73°). The digit divergence seems low and regular (I-II 23°, II-III 14°, III-IV 24°, IV-V 33°), the II-IV divergence is 39°, the total divergence is 98°, values on average. The sole is broad and well-impressed, u-shaped, and long about as half of the foot length (sole length 8-44 mm, average 19 mm, sole width 7-70 mm, 23 mm on average; psL/FL 2, on average).
Manus: tetradactyl, plantigrade, smaller than pes and about as long as wide (foot length 11-51 mm, average 27 mm; foot width 8-59 mm, average 29 mm; FL/FW 1, on average), with short and broad digits, distally rounded. The digit length slightly increases from digit I to digit III (length of digit III 4-22 mm, average 13 mm), digits II and III have similar length. Digit proportions: I<IV<II<III. Digit width is high and regular, and around 5 mm. The digits depart radially from the palm (Cross axis angle of 79°). The digit divergence is low (I-II 25°, II-III 16°, III-IV 20°), the II-IV divergence is 36°, the total divergence is 62°. Values on average. The palm is broad and well-impressed, u-shaped, and long about as half of the foot length (palm length 5-29 mm, average 15 mm; palm width 5-57 mm, average 25 mm; psL/FL 1.9, on average).
Trackway pattern: Trackways are disposed in a regular alternating arrangement of manus-pes couples. The speed of locomotion is moderate (stride length of 67-225 and 56-223 mm, average 119 and 112 mm; SL/FL 2.9-5.7, 4.5 on average; length of pace of 28-138 and 26-125 mm, average 56 and 54 mm; for the pes and the manus, respectively). The pace length is slightly lower in the manus, this is consistent with a more internal position of the manus (47-175 and 46-150 mm, average 80 and 71 mm; for the pes and the manus, respectively). Pace length can be markedly asymmetrical. The pace angulation is medium to high, this reflects a moderate gait, and it is slightly higher in the manus, because of its internal disposition (65-133° and 72-132°, average 96° and 105°; in the pes and the manus, respectively). LE is 3.1, on average. The pes is close to the manus and in some cases overstepping it (manus-pes distance 6-75 mm, average 24 mm). The manus is more internal than the pes (external trackway width 73 and 56 mm, width of pace 54 and 43 mm, interpedes/manus distance 35 and 26 mm; in the pes and the manus, respectively. Values on average). The manus is parallel to the midline or slightly rotated inwards (divergence of 10°, on average), the pes is parallel to the midline or rotated outwards (divergence of -22°, on average). Apparent body length is 47-148 mm, 74 mm on average. SL/BL is 1.6, on average.

REMARKS

The presence of this ichnotaxon has been ignored in previous studies of tetrapod ichnofauna of Southern Alps, this is probably due to its similarity to *Amphisauropus kablikae*, especially in size

and morphology of imprints. This is the case of sp. MBS 318, 317, collected in 1873 by Don G. Bruni in the Brescian Prealps, and classified by Ceoloni et al. (1987) as *Amphisauropus latus*; and sp. MBG 12527, from the Orobic Basin. The new material permitted us to clearly discern the two ichnotaxa in the Southern Alps, the main differences are: 1) the number of digits in manus imprints (4 in *L. heterodactylus*, 5 in *A. kablikae*), 2) the morphology of manus imprints. As long as wide, with u-shaped palm and straight digits in *Limnopus*; wider than long, with rectangular palm, central digits bent in *A. kablikae*; 3) the disposition of footprints along trackway (aligned to the midline in *L. heterodacylus*, with manus strongly rotated inward in *A. kablikae*).
The foot length is generally between 20 and 50 mm, but footprints of larger size were also observed (this is the case in specimen UR 27), a pes imprint with foot length of 71 mm, foot width of 89 mm and length of digit IV of 38 mm. A typical feature of this ichnotaxon, rarer than in *Amphisauropus*, is the presence of a prominent digit I basal pad (sp. UP 19, NS 43-159). Tracks can be also deformed because of wet substrate (sp. UP 19), this is consistent with the habits of the supposed trackmaker, a basal amphibian. The sole and palm are usually well-impressed, but they could be absent in undertracks (sp. NS 43-159), or in semi-plantigrade trackways (sp. INF 8).
Noteworthy the specimen INF 8 (Val Gerola site, Pizzo Trona locality), that shows a very long trackway (28 manus-pes couples), with three changes of direction during locomotion and a small trait with a thin sinuous tail impression. The gait was quite fast, this would explain the semi-plantigrade impressions, and the size is small (foot length of 21 mm).
The specimen CT 3 (Val Gerola site, Pizzo Trona locality), displays a moderately-long trackway with a large, deep and continuous tail impression, in a perfectly straight arrangement, with expulsion rims. This is in contrast with the lateral movement of the body, testified by the arcuate scraches departing from the medial pes digits.
During the locomotion, the pes and the manus are usually aligned to the midline, but in some cases they could assume an irregular pattern (sp. CT 3, INF 8, UP 19). Pes is close to the manus, and overstepping of the pes on the manus is sometimes observed (sp. INF 8, UP 19, MBS 277).

DISCUSSION

The ichnogenus *Limnopus* was introduced by Marsh in 1894 (*Limnopus vagus*), in a study of the Coal Measures of Kansas. The main feature of these imprints is the tetradactyl manus, but the overall morphology seems a larger version of *Batrachichnus* Woodworth 1900 (foot length larger than 20 mm, Haubold et al., 1995, Haubold, 1996).

Tucker & Smith (2004) proposed a differentiation based on statistical analysis, reducing the ichnogenus *Batrachichnus* to subichnogenus of *Limnopus* and differentiating the ichnospecies *Limopus vagus*, *L. salamandroides* and *L. plainvillensis*. This analysis was rejected by Lucas et al. (2005, 2011), they considered this separation too confusing. Voigt (2005) recognized the possibility of some morphological differences (width-length ratio of manus imprint, relative length of IV digit), but assigned this kind of footprints to *Limnopus-Batrachichnus* in plexus, waiting for a careful revision of the ichnogenera. Recently, a work of revision on some Pennsylvanian specimens of western Pennsylvania (Lucas & Dalman, 2013), revealed that the first description of the ichnogenera *Limnopus* is from King (1845), who named some *Limnopus* tracks as *Thenaropus heterodactylus*, thus the first valid name of *Limnopus* is *L. heterodactylus*. The Italian specimens exhibit all the characteristics of *Limnopus* Marsh 1894, and are well differentiated from tetrapod of medium size already known from the South Alpine region (*Amphisauropus, Varanopus*) because of the disposition of footprints along the trackway, different size of manus and pes, morphology and number of digits of manus imprints. These footprints are assigned to *Limnopus heterodactylus* (King, 1845), the first described along *Limnopus* ichnogenus (*L. vagus* Marsh 1894, *L. zeilleri* Delage 1912 and *L. cutlerensis* Baird 1965 are successive). Complete tracks and trackways, in a good preservation state, allowed a reliable study on track and trackway parameters of this ichnogenus. The absence of an acceptable record of *Batrachichnus* from the Italian material, hampers a reliable comparison between these two ichnogenera, thus they were simply discerned by size (*Limnopus* has foot length larger than 20 mm), as suggested by Haubold et al. (1995), although this is not a diagnostical feature.

Limnopus has been reported also from the USA (Marsh, 1894, Baird, 1952, 1965, Haubold et al., 1995, and Lucas & Dalman, 2013); Canada (Van Allen et al., 2005); England (Tucker & Smith, 2004); France (Delage, 1912, Heyler & Lessertisseur, 1963, Gand, 1988, and Gand & Durand, 2006); Germany (Haubold, 1971, 1996, and Voigt, 2005); Morocco (Voigt et al. 2011, 2011b).

The trackmakers are widely accepted as medium-size temnospondyls (Haubold, 1971, Gand, 1988, Haubold, 2000, Tucker & Smith, 2004, Van Allen et al., 2005, Voigt, 2005, and Gand & Durand, 2006), like *Eryops* (Haubold, 1971, Gand, 1988) or *Amphibamus* (Van Allen et al., 2005).

Ichnogenus *Varanopus* Moodie, 1929

Material: CT 2, LI 6, LI 22, MSNM 34, UP 1, UP 2, UP 3, UP 4, UP 5, SV 13-28, MBG 8834, MBG 10108-10132, MBG 12527, MBS 255, MBS 264, MBS 10978, NS 43-104, NS 43-148.

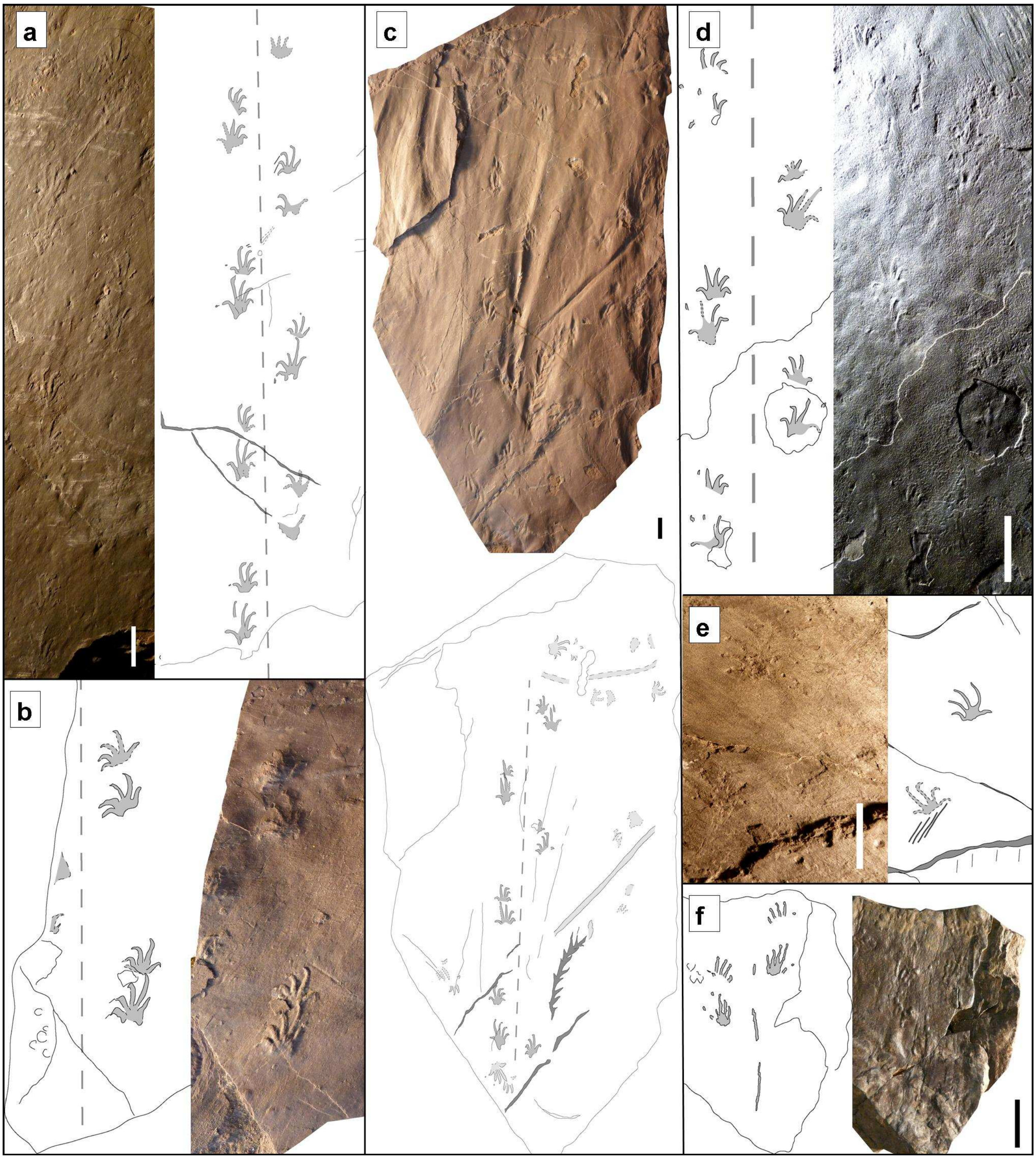

FIG 13. ***Varanopus.*** **Tracks and trackways. a) Sp. MBG 8834. b) Sp. UP 2. c) Sp. UP 1. d) Sp. SV 13-28. e) Sp. MBS 264. f). Sp. ML 2.8. Scale bar 20 mm.**

DESCRIPTION

Quadrupedal, semiplantigrade tracks of a tetrapod of small to medium size.

Pes: Pentadactyl, longer than wide (foot length 8-50 mm, average 18 mm; foot width 7-42 mm, average 16 mm, FL/FW 1.2, on average). The digits are long and slender and terminate in claws. The digits I-IV are distally bent inwards, the digit V can be bent outwards. The digit length increases from I to IV (the length of digit IV is 4-23 mm, average 11 mm). Digit proportions: I<V<II<III<IV. A median-lateral decrease in relief is possible, and causes a reduced impression of the digits IV and V. The digit width is reduced (about 2 mm), and it is slightly higher in the lateral digits. The digits diverge radially from the palm (Cross-axis angle of 62°). The digit divergence is low between median digits (II-III 21°, III-IV 15°), and higher between outer digits (I-II 28°, IV-V 33°), the II-IV divergence is 36°, the total divergence is 97°. The sole impression has a characteristic bi-lobed shape, caused by the strong impression of the basal pads of the digits I and V. It is long less than half foot length (sole length 5-26 mm, average 8 mm; sole width 5-29 mm, average 8 mm; FL/psL 2.4, on average).

Manus: Pentadactyl, smaller than pes, and longer than wide (foot length 7-36 mm, average 15 mm; foot width 6-35 mm, average 14 mm; FL/FW 1.1, on average). The digits are long and slender and terminate in claws. The digits I-IV are distally inwards bent, the digit V can be outwards bent. The digit length increases between the digits I-IV (the length of digit IV is 5-23 mm, average 10 mm). Digit proportions: I<V<II<III<IV. The digit width is reduced (around 2 mm) and is slightly higher in outer digits. The digits diverge radially from the palm (cross-axis of 66°). The digit divergence is lower between median digits (II-III 20°, III-IV 21°), and higher between outer digits (I-II 40°, IV-V 44°), the II-IV divergence is 42°, the total divergence is 124°. The palm is short, rectangular in shape, and wider than long. It is long about 2/5 of the foot length (palm length 2-10 mm, average 6 mm; palm width 3-14 mm, average 7 mm; FL/psL 2.9, on average).

Trackway pattern: The trackways are disposed in a regular alternating arrangement of manus-pes couples. The speed of locomotion is moderately high (stride length of 38-116 and 53-117 mm, average 87 and 89 mm; SL/FL 1.8-10.3, average 5.7; length of pace of -3-67 mm and -3-68 mm, average 42 and 43 mm; for the pes and the manus, respectively). The pace length is asymmetrical (left to right 52 and 51 mm, from right to left 59 and 57 mm, for the pes and the manus, respectively. Values on average).

The pace angulation is medium to high, this reflects different gaits, and it is slightly higher in the manus (43-126° and 47-129°, average 101° and 110°; in the pes and the manus, respectively). LE is 2.6, on average. The pes is close to the manus and occasionally overstepping it (manus-pes distance

6-35 mm, average 17 mm). The manus is directly in front of the pes (external trackway width 48 and 42 mm, width of pace 34 and 30 mm, interpedes/manus distance 20 and 19 mm; in the pes and the manus, respectively. Values on average). The manus is slightly rotated inwards (manus divergence of 8°, on average), the pes is parallel to the midline or slightly rotated outwards (pes divergence of -2°, on average). The apparent body length is 36-94 mm, average 61 mm. SL/BL is 1.5, on average.

REMARKS

This ichnotaxon is moderately diffuse in the Southern Alps. The footprint length is commonly between 20-30 mm, but specimens with larger (sp. MSNM 34, NS 43-148), or smaller sizes (sp. ML2 8), are also recorded. Noteworthy are the specimens MBG 8834 and UP 1 (trackway 1). They show optimally-preserved plantigrade trackways, in a perfectly alternating arrangement, with the characteristic bi-lobed palm impression of the pes, digits I-V completely preserved, and pointed claw impressions. In sp. SV 13-28, an evident median-lateral decrease in relief is observable, it causes the preservation of the only digit IV-V tips in the lateral part of the tracks. In some cases, semi-digitigrade trackways are observed (sp. MBG 12465, trackway 2).
The pes digit V is commonly outwards bent, and this causes an underestimation of the digit V length. In sp. ML2 8 the pes digit V is instead straight and forward directed, this is reflected by a lower total divergence of the footprints and an higher length of the digit (between II and III), characters resembling the ichnospecies *V. microdactylus*.
Tail impression is also recorded in some cases, and appears slightly sinuous (sp. UP 1 trackway 2, UP 4, ML 2 8).

DISCUSSION

The ichnogenus was introducted by Moodie in 1929, from the study of some scattered footprints of the early Permian Choza Formation of Castle Peak (Texas). It was revised and confirmed by Haubold & Lucas (2001; 2003), who made a clear attempt to discern it from the ichnogenus *Erpetopus* Moodie, 1929 with the study of new material. Previous studies on the French and Italian material did not consider the separation between these ichnogenera, thus several *Erpetopus* specimens were classified as *Varanopus*. This is the case of the specimens described by Santi & Krieger (2001) as *Varanopus*. The footprints assigned by these last to *Domopus lacertoides* (sp. MBG 8834) and some of the material described by Nicosia et al. (2000), are instead *Varanopus* (sp.

UP 1, 2, 5). The material from the Southern Alps, although not abundant, includes optimally-preserved tracks and trackways (sp. MBG 8834, UP 1, SV 13-28), which allowed taxonomical studies. The trackway and trackways parameters are different from the ichnogenus *Erpetopus*, and are instead comparable to *Varanopus*. These features include: a different trackway pattern (extremely regular, with manus and pes aligned to the midline in *Varanopus*; more irregular, with inward-oriented manus and variabily-oriented pes in *Erpetopus*), a different pes and manus structure (with longer tracks, longer and thinner digits, lower and regular digit divergences, and shorter palm impressions in *Varanopus*) and a different track size (*Varanopus* is larger, although this is not a diagnostical feature).
Two ichnospecies were considered valid in the revision of Haubold (2000): *V. curvidactylus* Moodie, 1929 and *V. microdactylus* (Pabst, 1896). After a careful comparison, it became clear that these ichnospecies are probably indistinguishible, so it is valid the first described, i.e. *V. microdactylus* (Voigt, 2005). The main feature of this taxon is the length of the pes digit V, long about as digit III and not bent. This is clearly different from the Italian material, although this last is well distinguishable from *Erpetopus* (i.e. different pes structure and trackway pattern), so another ichnospecies name should be utilized.
The trackmakers were probably basal captorhinids (Haubold, 1971, Gand, 1988, Haubold, 1996, 2000, Haubold & Lucas, 2001, 2003, Voigt, 2005, Voigt et al., 2005, Gand & Durand, 2006, and Voigt et al., 2013), protorothyridids (Haubold & Lucas, 2001, 2003) or pelycosaurs (Van Allen et al., 2005).

Undetermined traces

Material: PDVcII 15, PF 2, MBG 288, MBG 8830, MBG 12461, MBS 169, MBS 292.

REMARKS

In the whole footprint collection of the Early Permian of the Southern Alps, some unclassified specimens are worth to be cited. From optimally-preserved tracks and trackways we know that the Italian ichnofauna is composed by seven ichnogenera, and the maximum registered size is around 70 mm. Some supposed fossil footprints are larger (>100 mm), so they could belong to different ichnogenera. The specimen MBG 288 shows two large and elongated consecutive impressions, 250 mm long and 10 mm wide. On the external part of the first one a possible expulsion rim is recognizable. The impressions are filled with some material, which hampers the recognition of the morphology. The specimen MBG 8830 preserves two supposed consecutive footprints, preserved as natural cast. The right impression shows only three digits, badly preserved (digit length about 80 mm, digit width 25 mm). The left impression has a peculiar shape, with an elongated basal part, a middle depression and three digits, with elongation marks. A possible interpretation is a plantigrade impression with deformation of the first digit (abnormally large and straight), and successive generation of large digit scratches from the supposed digits II-III, mainly departing from the claws). The length of this track is about 200 mm, the width is about 100 mm, the digits are 60-70 mm long and 15-30 mm wide. All these traces are too badly preserved to give a sure attribution, but they could pertain to the same ichnogenera, cf. *Dimetropus lesnerianus*.

The specimen MBG 12461 shows some elongated and extremely curved digits, with acuminate terminations. The size is too large to pertain to *Dromopus*, so they could be classified as cf. *Tambachichnium*, but a sure attribution is impossible.

Some specimens from the Val Trompia site (Collio Formation, Val Dorizzo member, sp. MBS 292, UR 169), preserve a peculiar four-pointed symmetrical shape, with four thin and elongated impressions departing in the anterior and posterior parts of the track.

The length of and the width of these signs is about 15-20 mm. They resemble some observed anvil-like tracks, interpreted as extramorphologies of *Erpetopus* (sp. NS 43-104b, NS 43-311). The size and the thinner impressions seem to point to a different ichnotaxa, *Varanopus*.

The specimen PDVcII 15 shows some thin, continuous and parallel scratches, which suddenly change the direction, assuming a peculiar hairpin-shape. These impressions, in groups of three or four scratches, and about 15 mm wide, can be interpreted as submerged locomotion signs of tetrapods, suddenly going in the opposite direction for some reason (it appears simultaneous, so it could be the current changing direction). In any case, these traces lack any reference to recognizable footprints, and their attribution to swimming traces is uncertain.

The specimen PF 2 shows a peculiar trace, which is probably a locomotion trail, but its classification is uncertain. The sinusoidal thin trace in the middle part of the impression and the arcuate scratches on its side, both in groups of three, could represent a tetrapod moving on a slippery substrate, but the extremely regular and continuous pattern and the lack of autopodia hampers a correct interpretation.

6) THE ICHNOSITES

1. Val Gerola (W Orobic Basin, Pizzo del Diavolo Fm.)

The Val Gerola ichnosite is one of the most representative sites of the Early Permian of the Southern Alps. It is located on the extremity of a lateral valley of Valtellina, the Val Gerola (Sondrio/Lecco provinces, Lombardy). It extends between the extremity of Val Varrone (Pizzo Varrone), the Valle dell'Inferno and the Bocca di Trona pass. Several researches emphasized its fossil footprint content (Ceoloni et al. 1987, Cassinis et al., 1998, Santi & Krieger 1999, Nicosia et al., 2000, and Gianotti et al., 2001).

In this sector of the Orobic Basin (Orobic anticline), the sedimentary Pizzo del Diavolo Fm. outcrops extensively, and is characterized by frequent changes of granulometry and facies.

The fossiliferous pelitic lithofacies alternates with the arenitic and the conglomeratic lithofacies (Ponteranica auct.), which are prevailing in this area. Reworked pyroclastic intervals and freshwater carbonates (stromatolites, algal oncoids) are also present (Nicosia et al., 2000, Gianotti et al., 2001, and Ronchi & Santi, 2003).

New field work was focused on three different localities: Pizzo Varrone-Valle dell'Inferno (1), Pizzo di Trona (2), and Bocca di Trona (3).

The locality 1 is located on the eastern side of the Valle dell' Inferno, from the Pizzo Varrone and F.A.L.C. mountain shelter, to the outcrops north to the Lago Inferno dam. It is the classic fossiliferous locality known from literature, often cited as "Collio red strata". It is characterized by an alternation of massive or stratified grey-green sandstones and laminated siltstones and mudstones, more frequent and red in color in the upper part of the succession. Fine pyroclastic levels are also present. The fossiliferous strata are in the upper part of the interval, in the last 20-30 m of the Early Permian succession, which can be followed laterally for about 2 km. Sedimentary structures include: fining-upward cycles, cross and parallel laminations, autoclastic breccias, clay chips, carbonate crusts, reduction spots, concretions, rain drops, mud cracks, root traces, ripple marks, wrinkle stuctures, and tool marks. Thin-sections analysis revealed the presence of small microbial structures with radial growth from pre-existing bioclasts (thrombolite-like, sp. IF 4) or thin and laterally-extended encrusting structures (stromatolite-like, IF 3). The succession ends with the Upper Permian Verrucano Lombardo red beds, in clear angular unconformity (10°). Stratigraphic sections of this interval have been described by Nicosia et al. (2000) and Gianotti et al. (2001). The paleoenvironment has been interpreted as a distal fan delta setting with ephemeral lakes (Ronchi & Santi, 2003).

The ichnoassociation comprises: *Amphisauropus*, *Erpetopus, Dromopus, Hyloidichnus*, *Varanopus, Limnopus* (in order of abundance). The association is well-differentiated and the most abundant track is *Amphisauropus*, often preserved as undertrack (*Laoporus*), digit scratches and sliding traces of the pes are also common. In some cases also trackways with continuous and perfectly sinusoidal tail traces are noticed. Preservation of material is very fine, and complete trackways of *Amphisauropus*, *Dromopus*, *Varanopus*, *Erpetopus* are observed (sp. CT 2, CT 4, UP 1, UP 13), occasionally in situ (sp. INF 5, 6).

The invertebrate traces include *Diplopodichnus biformis, Helminthoides hieroglyphica* and undetermined arthropod traces. A freshwater jellyfish (*Medusina atava*) was signaled by Santi (2003). Plant fossils include abundant silicified plants and trunks and rare fossil conifers (*Walchia*, first noticed by Casati & Gnaccolini, 1967).

The locality 2 is situated on the western side of the Lago Inferno, and on the eastern slope of Pizzo di Trona. Fossil traces were found in loose material and huge blocks, coming from a 100-150 m thick interval of black and intensely laminated mudstones and siltstones. Freshwater carbonates (stromatolites and algal oncoids), were signaled by Ronchi et al. (2003), who interpreted the paleoenvironment as distal floodplain to lacustrine.

The sedimentary structures include: even and cross lamination, syneresis cracks, mud cracks, ripple marks, rain drops, wrinkle structures, and tool marks. Soft-sediment deformation and liquefaction structures are common and include: ball-and pillow structures, dewatering structures, convolute lamination, and plastic intrusions. The ichnoassociation comprises few forms: *Dromopus, Amphisauropus*, and *Limnopus* (in order of abundance). The most abundant track is *Dromopus*, surfaces with hundreds to thousands of tracks are not unusual. Amphibian traces are quite common, in this site the longest and most complete trackways of *Limnopus* were found, with perfectly straight or slightly sinusoidal tail impression and plantigrade or semi-semiplantigrade preservation (sp. CT 3, PV 19, INF 8). Also long *Amphisauropus* trackways were observed (CT 3, INF 8), in some cases with perfectly sinusoidal tail impressions.

The locality 3 extends on both sides of the Bocca di Trona pass. Fossil footprints come from about 10 m of yellow-gray and black laminated mudstones and siltstones, with coarse conglomerates (Ponteranica auct.) on the base and the top of the interval. Sedimentary structures include: plane and cross lamination, wrinkle structures, ripple marks, syneresis cracks, tool marks, root traces, rain drops. The environment was probably alluvial fan with small ponds in the inactive or distal parts of the fans. This is the type locality of the fossil conifer *Cassinisia orobica* (Kerp et al., 1996). Stratigraphic sections of this area have been described by Gianotti et al. (2001).

The ichnoassociation comprises: *Dromopus, Erpetopus, Amphisauropus, Varanopus* (in order of abundance). The association is *Dromopus*-dominated, but here captorhinomorph tracks (*Erpetopus, Varanopus*) are quite common and optimally-preserved (sp. SV 13-28, SV 13-28b). Other fossils comprises plant remains and a supposed shark-egg case.

The integrate study of the collections and new material from the historical (1) and two new localities (2, 3), with a correct evaluation of the sedimentary facies, permits some considerations. The ichnoassociation is more complete and diversified than previously known. We found *Amphisauropus, Dromopus, Erpetopus, Limnopus, Varanopus, Hyloidichnus*. It is perfectly comparable to the association of the lower Collio Fm. of the Collio Basin (Pian delle Baste member), so the age is probably Early Kungurian (283-280 Ma from radiometric dates, Schaltegger & Brack, 2007). The fact that we found it directly overlained by the Upper Permian rocks suggests stronger erosion rates in this area, we are in fact in the most proximal areas of the Orobic Basin. The association results diversified and *Amphisauropus*-dominated in locality 1, restricted and *Dromopus*-dominated with amphibian traces (*Limnopus*) in locality 2, and *Dromopus*-dominated with captorhinomorph traces (*Erpetopus, Varanopus*) in locality 3. The facies analysis suggests different paleoenvironments: distal alluvial fan to proximal floodplain in locality 1, distal floodplain to lacustrine with wetter environment and repeated inundations in locality 2, and proximal alluvial fan with small lakes in locality 3. The *Dromopus*-dominated ichnofaunas are associated with distal-floodplain or lacustrine settings, the wetter environment is suggested by the presence of amphibians traces (*Limnopus*). Sedimentary structures (syneresis cracks, algal oncoids) and the reducing conditions support this hypothesis. *Amphisauropus*-dominated ichnofaunas are associated with distal fan and proximal floodplains, with a more developed ichnofauna, invertebrate traces and plant remains and root traces. These data suggest that different paleoenvironments changed the ichnofaunal composition, so the ichnoassociation would be facies-controlled.

The fine laminated mudstones and siltstones of the black facies and the reworked tufitic material of the upper red shales enable optimal preservation of tracks and trackways, in some cases even the scaly skin impression is recognizable (sp. MSNM 27, LI 14). In addition, the exceptional preservation of *Amphisauropus* footprints allows inferences on behavior of such ichnotaxon: continuous tail impression in a sinusoidal arrangement and curved and continuous digit scratches were found (sp. CT 2, 3). These features are unusual for this ichnotaxon (the only similar report is from Canada, Van Allen et al., 2005).

From the revision study of the Early Permian ichnofauna of this area emerges: **1)** the ichnoassociation is more complete than previously known (six tetrapod ichnogenera and two invertebrate traces), **2)** the abundance and optimal preservation of the material enable systematic and behavioral studies, **3)** the distribution and relative proportion of the tetrapod ichnotaxa suggest a facies-controlled ichnofauna.

2. Monte Ponteranica (W Orobic Basin, Pizzo del Diavolo Fm.)

This ichnosite is located in the W Orobic Basin, in the Orobic anticline, between the provinces of Sondrio and Bergamo. It extends from the southern extremity of the Valle di Pescegallo (high Val Gerola) to the northern extremity of the Val Mora (lateral of the Val Brembana), including the Lago di Pescegallo, the Rocca di Pescegallo, the Monte Avaro, the Monte Triomen, the Monte Mincucco, and the Lago Valmora localities.
It is close to the Val Gerola (W) and to the Val di Scioc (S) ichnosites. It has been distinguished from this last for historical reasons. Tetrapod ichnoassociation and invertebrate traces have been studied by Gianotti et al. (2002) and Santi & Stoppini (2005), the latter focusing on the predator-prey interactions.
Stratigraphic sections with fossil footprints have been described in Gianotti et al. (2002). The Geology of the area is similar to those of the Val Gerola site, with the Pizzo del Diavolo Fm. characterized by frequent alternations of facies. The fine laminated fossiliferous levels (pelitic member), are interfingered with the arenaceous and conglomeratic ones, in complex geometries. In this area the conglomeratic levels are very thick and predominant, this is in fact the type area of the Ponteranica conglomerate auct., the site extends around the Monte Ponteranica.
The ichnoassociation is composed by: *Dromopus*, *Erpetopus*, *Amphisauropus*, *Hyloidichnus* (in order of abundance). Invertebrate traces includes the arthropod traces *Dendroidichnites elegans* and *Heteropodichnus variabils* (Gianotti et al., 2001, Santi & Stoppini, 2005). Further considerations on the ichnoassociation are useless, since the material is few and not stratigraphically located.

3. Val di Scioc (W Orobic Basin, Pizzo del Diavolo Fm.)

The Val di Scioc site is located near the village of Ornica (Bergamo province), on the immediately south to the Ponteranica site (western Orobic Basin, Orobic anticline). It includes the localities

Curva Scioc and Piani dell'Avaro. The latter is probably the same locality cited by Gianotti et al. (2001), on the south to the Monte Avaro, for the Ponteranica site. Fossil footprints from this locality were figured by Casati & Gnaccolini (1967), and later Classified by Ceoloni et al. (1987). The material of the Curva Scioc locality was studied by Toniutti (1985), Arduini et al. (2003) and Santi (2003).

The stratigraphic framework is analogue to those of the Val Gerola and Ponteranica sites, with the Pizzo del Diavolo Fm. outcropping in pelitic, arenitic and conglomeratic facies (alluvial plain with fan deltas on its sides, and small lakes in the inactive parts of the fans).

The Curva Scioc locality is situated on the left of the first hairpin bend of the road which goes from the village of Ornica to the Ca del Sul refuge. The material comes from a small interval characterized by mudstones and fine siltstones with mud cracks, rain drops, and ripple marks.

The association comprises: *Erpetopus, Hyloidichnus, Batrachichnus,* and *Dromopus* (in order of abundance). *Erpetopus* is by far the predominant form. It is found in three different morphotipes, with different size. Several trackways are recognizable, in a complete range of gaits and preservation states.

Noteworthy is the specimen V 7039, which shows two long trackways crossing each other, many other footprints and swimming traces. The preservation of tracks is optimal. The most interesting feature is the passage of some plantigrade impressions to scratches typical of swimming behavior. This is an important clue for the generation of this kind of traces from *Erpetopus*. Other fossils include invertebrate traces (*Helminthoides hieroglyphica*) and conifer remains (*Walchia*).

The locality Piani dell'Avaro is situated on the south-east of the Monte Avaro, in correspondence of the Ca del Sul refuge. Two stratigraphic sections of this area were described by Gianotti et al. (2002). Few specimens come from this locality, the only ichnotaxon found is *Erpetopus*.

The ichnoassociation of the Val di Scioc site results *Erpetopus*-dominated, the other ichnotaxa include *Hylodichnus* and *Batrachichnus*. The presence of *Varanopus* (Arduini et al. 2003), cannot be confirmed, since the figured material was not avalaible.

Invertebrate traces include burrows (*Helminthoides hieroglyphica*) and arthropod tracks (*Terricolichnius permicus*). This last was described by Alessandrello et al. (1988). Sciunnach reported also bivalves (?*Anthracondauta*) from the locality Averara. Plant fossils include the conifer *Walchia* (Arduini et al. 2003).

4. Laghi Gemelli (Orobic Basin, Pizzo del Diavolo Fm.)

The Laghi Gemelli ichnosite is located in the central southern part of the Orobic Basin, in the Trabuchello-Cabianca anticline. It extends on both sides of the Pizzo Farno, close to the Laghi Gemelli (Bergamo province).
The only described specimen coming from this site is MUSE 5721, showing an *Erpetopus* trackway with tail impression, digit scratches, and a supposed belly trace (Bernardi & Avanzini, 2011). Fossil footprints were signaled also by Berra & Felletti (2011).
Here the Pizzo del Diavolo Fm. outcrops extensively, with its characteristic facies alternation. The succession can be followed from thick lenticular grey-green sandstones (arenitic lithofacies) to fine laminated siltstones-mudstones reddish/black in color (pelitic lithofacies) and ends with the deposition of the Verrucano Lombardo strata, in clear angular unconformity. Freshwater carbonates, mainly represented here by oncoidal structures (up to 5 cm of diameter), are quite diffuse. In the upper part some green fine pyroclastic layers can be observed. Sedimentary structures include: planar and cross laminatons, rain drops, ripple marks, flute casts, tool marks, mud cracks, wrinkle structures, root traces, degassing structures, and diagenetic nodules.
This succession has been defined by Berra & Felletti (2011) as the "upper lithozone" of the Pizzo del Diavolo Fm. and interpreted as a floodplain environment with ephemeral lakes.
The association lists: *Dromopus, Batrachichnus, Erpetopus,* and *Amphisauropus* (in order of abundance). *Dromopus* and *Batrachichnus* are the most common forms, this last is commonly found in a bad preservation state. Footprints deformation, digits elongation and swimming traces related to this taxon testify to a slippery and wet substrate, adequate for its amphibian trackmaker (sp. PDVcII 4, 7, PF 2). The preservation of the other forms is optimal, this is probably linked to the consinstency and type of sediment: intensely laminated mudstones/siltstones and reworked cineritic layers. In the first case a peculiar preservation style, with red siltstones in the depressions, and mudstones out of them is observed (sp. MUSE 5721, PF 3). Noteworthy are some *Erpetopus* trackways, with different types of tail impressions and digit scratches (sp. MUSE 5721, PDVcII 16, PF 8).
Invertebrate traces are common and optimally-preserved. The association lists: *Bifurculapes, Eisenachichnus, Dendroidichnites irregulare, Diplichnites gouldi, Helminthopsis hieroglyphica* and *Scoyenia gracilis* (Santi comm. pers.). Arthropod traces are dominant on the burrow traces, this is typical of the Scoyenia ichnofacies recognized in the Orobic Basin by Santi (2007), and in the Collio Basin by Contardi & Santi (2009) and Avanzini et al. (2011).
The frequency of amphibian tracks (*Batrachichnus*), digit scratches, swimming traces, raindrop impressions and the reducing conditions indicate a wet environment. The predominance of arthropods traces on the burrowers (Minter et al., 2007), the intensely-laminated sediment, the

frequency of trampled layers and the fine sediment suggest a low-energy environment with repeating flooding, sometimes interrupted by high-energy episodes (oncolites). This is typical of a distal floodplain environment, with ephemeral lakes or channels.

5. Val Brembana (Orobic Basin, Pizzo del Diavolo Fm.)

The Val Brembana site is the most extended and known site of the Orobic Basin. It is located in the northern central sector of the Orobic Basin, in the Trabuchello-Cabianca anticline. It extends mainly in the higher part of Val Brembana, and some sectors of Val Seriana (Bergamo province). It includes the localities: Conca dei Calvi, Monte Aga, Val Camisana, Bocchetta Podavit, Pizzo del Diavolo, Valsecca, Passo di Valsecca, Pizzo Redorta and Rifugio Curò.
Fossil footprints from this site are known since the first half of the 20th century (Dozy, 1935), but successive works are quite recent (Santi, 1999, Santi & Krieger, 2001, Confortini et al., 2001, Ronchi et al., 2005, and Petti et al., 2011).
The Pizzo del Diavolo Fm. reaches its maximum thickness in this zone, the northern part of the basin was in fact more subsiding. The fossiliferous pelitic lithofacies outcrops extensively, and alternates with the arenitic, and in some zones also with the conglomeratic lithofacies (Monte Aga). The tectonic influence is strong in this zone, fracturing and cleavage structures are diffuse.
A possible type-section of the Pizzo del Diavolo Fm. has been described by Ronchi et al. (2005), in the localities Val Camisana and Bocchetta Podavit, on the western slope of the Pizzo del Diavolo. This 600 m thick section shows a transition from greenish stratified sandstones (arenitic lithofacies) to black fine siltstones and mudstones, with tetrapod footprints (pelitic lithofacies). Sedimentary structures include coarsering- and fining- upwards trends, parallel and cross lamination, rain drops, ripple marks, and mud cracks. Cinerite layers occur at different levels, and soft-sediment deformation and liquefation structures (sand dikes, pillow structures, convolute lamination, grow faults, microslumpings, and load casts) are very common and indicate sin-sedimentary tectonics, possibly linked to volcanic activity. The paleoenvironment was interpreted as a distal braided fluvial system with widely developed floodplains.
Several complete trackways of *Erpetopus* come from this site, the fine preservation allowed taxonomical studies, showing that a separation of the ichnogenera in two ichnospecies (*E. willistoni* and *E.cassinisi*) could be justified, at least for the Southern Alps domain. Noteworthy the sp. 12465 (Pizzo del Diavolo locality), which preserves four long, almost complete and well-preserved trackways of *Erpetopus*, and a trackway attributed to *Varanopus*, crossing each other. The in-situ

sp. VS 6 (Valsecca locality, fallen block), described by Petti et al. (2011), shows several long *Batrachichnus* trackways, impressed in different situations (wet substrate, water-saturated substrate and shallow water). Particularly interesting the terrestrial/acquatic transition of the trackmakers. Other remarkable specimens are the casts coming from a fallen block in the Val Camisana locality (sp. MBG 12529, 12530, 12531, 12532, 12533), with optimally-preserved *Amphisauropus* and *Hyloidichnus* tracks, the sp. MBG 8834 (Monte Redorta locality), with a complete and optimally-preserved *Varanopus* trackway, suitable for taxonomic studies and some undetermined tracks of large size (sp. MBG 280, 8830, 12461).

The ichnoassociation comprises: *Erpetopus, Batrachichnus, Amphisauropus, Dromopus, Hyloidichnus, Limnopus, Varanopus* (in order of abundance). *Erpetopus* is by far the most common form, and *Batrachichnus* is quite common but not optimally-preserved, the other taxa are rarer, but every form of the Early Permian of Southern Alps is represented. Santi & Krieger (2001) compared this association to that of lower Collio Fm. in the Collio Basin. From this study emerges that the forms are the same, but the proportions between taxa are very different. In fact *Erpetopus*-dominated associations characterize this site, and *Amphisauropus*- or *Dromopus*- dominated associations those of Collio Basin. In the locality Pizzo Redorta the association includes several *Amphisauropus* specimens, but further researches are needed. These differences in the distribution of ichnotaxa could reflect slightly different paleoenvironments.

The invertebrate traces include: *Bifurculapes, Eisanachichnus,* cf. *Heteropodichnus variabilis, Dendroidichnites elegans, Paleobullia, Diplichnites gouldi* and *cf. Paleoelchura tridactyla* (Santi comm. pers.). These traces are linked to freshwater environments, surface imprints are more common than burrows, and there is a lack of biodiversity and monospecificity (Santi, 2007). Plant remains include the conifer *Walchia* (Confortini et al., 2001).

6. Val Trompia (Collio Basin, Collio Fm., Dosso dei Galli Fm.)

The Val Trompia site is the most known and studied area of the Early Permian of the Southern Alps. Its fossil content comprises tetrapod and invertebrate footprints, fossil plants, sporomorphs, freshwater bivalves and crustaceans. Vertebrate fossil footprints from the Val Trompia are known since the 19th century (Curioni, 1870), the ichnoassociation was defined by successive works (Berruti, 1969, Haubold & Katzung, 1975, Ceoloni et al., 1987, Conti et al., 1991, Conti et al., 1997, and Conti et al., 2000).

The site is located at the north-east extremity of the Val Trompia (Brescia province), and includes the localities: Sette Crocette pass, Malga Pofferatte Alta, Pulpito, Malga Cuta, Laghetto Dasdana, Malga Dasdana, and Malga Dasdana Corna (Conti et al., 1991).

In this area of the Collio Basin the Lower Permian succession outcrops almost entirely, from the Basal Conglomerate and the volcanic Lower Porphyries to the sedimentary Collio and Dosso dei Galli Fms. The succession ends with the deposition of the Upper Permian Verrucano Lombardo.

The type-section of the Collio Fm. has been described by Cassinis (1966) in the Val Dasdana.

It is now divided into two members: the Pian delle Baste and the Val Dorizzo members, divided by a volcanoclastic key-bed recognizable throughout the entire basin (Dasdana beds).

These members have been interpreted by Ori et al. (1986) as alluvial fan settings passing to sand-sheet and distal floodplain and lacustrine environments, from the base to the upper parts of both members, and from the western to the eastern part of the basin. The presence of basal volcanics (Lower Porphyries for the Pian delle Baste member, and Dasdana beds for the Val Dorizzo member), seems to indicate a period of stronger tectonic activity followed by fining- and thinning-upwards sedimentation. The upper part of the Val Dorizzo member interfingers with the lower part of the Dosso dei Galli Fm., constituted by coarse sandstones and conglomerates in a thickening- and coarsering- upwards trends, which testifies the closure of the basin with alluvial fans. In the inactive parts of the fans fine sedimentation occurs (Pietra Simona member).

Tetrapod footprints have been recognized in both Pian delle Baste and Val Dorizzo members of Collio Fm. and in some levels attributed to the Pietra Simona member of the Dosso dei Galli Fm.

In the locality Malga Pofferatte Alta, outcrops the lower-medium part of the Pian delle Baste member, also known as "green strata". Stratified and lenticular coarse- to medium- grained sandstones are predominant, and alternate with intensely laminated siltstones and mudstones. The sedimentary structures include: fining-upwards trends, parallel and cross lamination, root traces, ripples and diagenetic nodules. The preservation of tetrapod footprints is not optimal, but the ichnoassociation is complete. It comprises: *Amphisauropus, Erpetopus, Dromopus, Limnopus, Varanopus*, *Batrachichnus*, and *Hyloidichnus*. *Amphisauropus* is the most common form, *Erpetopus* and *Dromopus* are diffuse and the other ichnotaxa are rarer.

In the uppermost "red strata" (Malga Pofferatte Alta, Sette Crocette pass), fine laminated siltstones and mudstones are prevalent, and show parallel lamination, mud cracks, microbial structures and diagenetic nodules. Also fine pyroclastic levels are observed. The ichnoassociation is poorer and lists *Dromopus*, cf. *Batrachichnus* and cf. *Limnopus*.

The deposition of the Pian delle Baste member ends with the fine black laminated mudstones and sitstones of the "black stata" (Pulpito, Malga Cuta). Here the ichnoassociation is composed by:

Dromopus, *Limnopus*, *Batrachichnus*, *Erpetopus*, and *Amphisauropus*. *Dromopus* is by far the predominant form, followed by the amphibian tracks (*Limnopus*, *Batrachichnus*), the other forms are rarer. The *Amphisauropus* specimen described by Curioni (1870), comes from the Pulpito locality; the *Limnopus* specimens BS 317-318 were found in 1873 by Don Bruni in the locality Malga Cuta. These strata include abundant plant remains (Curioni, 1965, Geinitz, 1969, Remy & Remy, 1978, Visscher et al., 2001) and invertebrate traces (Conti et al., 1991, Avanzini et al., 2011). The sedimentary units of the Val Dorizzo member and the overlying Dosso dei Galli Fm. are well-exposed in the Val Dasdana. The localities Laghetto Dasdana and Malga Dasdana Busa are characterized by grey-black thin laminated siltstones and mudstones, corresponding to the medium-upper portions of the pelitic units of the Val Dorizzo member.

The two localities correspond to the same stratigraphic interval, a bivalve-rich key bed can be recognized in both sections (Berruti et al., 1969). The sedimentary structures include: planar "varved-like" lamination, ripples, mud cracks, wrinkle structures, rain drops, microbial strucutures, syneresis cracks and carbonate crusts. Convolute lamination and water-scape structures indicate a sinsedimentary tectonic activity.

The association lists: *Dromopus*, *Erpetopus* and cf. *Batrachichnus*. *Dromopus* is the predominant form, and *Erpetopus* is quite diffuse. The preservation of tracks is generally not optimal, this is probably due to the substrate wetness and consistency at the time of impression.

In the locality Laghetto Dasdana, Berruti found the *Camunipes cassinisi* holotype (i.e. *Erpetopus*, sp. BS 319), and in Malga Dasdana Busa the *Gracilichnium berruti* holotype (cf. *Batrachichnus*, sp. BS 323). These levels contain also abundant invertebrate traces (Conti et al., 1991, Contardi & Santi, 2009, and Avanzini et al., 2011), freshwatwer bivalves, crustaceans (Curioni, 1870, Berruti, 1969, and Conti et al., 1991), and plant remains.

At the top of these strata it begins the transition to the Dosso dei Galli Fm., with stratified medium-to coarse arenites and conglomerates in a coarsering- and thickening- upwards trend. Some small pelitic intervals occur at different levels: siltstones/mudstones layers, yellow-grey in color, with parallel and "varved-like" lamination, and abundant swimming traces (Malga Dasdana Corna). Here the ichnoassociation lists *Dromopus* and *Batrachichnus*.

North to the Malga Dasdana Corna, some fine red levels outcrop, with common bioturbations. These laterally not extended strata pertain to the informal Pietra Simona member of the Dosso dei Galli Fm., and are interpreted as deposition in small ponds between alluvial fans or in their inactive parts. Here the ichnoassociation lists *Dromopus* and *Amphisauropus* (sp. MBS 283). Vertebrate burrows were studied by Ronchi (2008), who identified *Planolites montanus*.

The ichnoassociation of the Val Trompia includes: *Dromopus, Erpetopus, Amphisauropus, Limnopus, Batrachichnus, Varanopus,* and *Hyloidichnus* (in order of abundance). *Dromopus* is by far the most common form, the other ichnotaxa are locally abundant. The preservation of footprints is generally not optimal, this is probably due to the coarse sediment (medium- to fine- arenites, e.g. Malga Pofferatte Alta), or to the wetness and the consistency of the finer sediment (fine siltstones/mudstones, e.g. Malga Dasdana Busa).

The possibility to place all the fossiliferous localities in a correct stratigraphic position, and the evaluation of the corresponding lithofacies, enable some stratigraphic and paleoenvironmental considerations. The reduction of the ichnoassociation, from the lower to the upper parts of the succession, hypothesized by Conti et al. (1991, 1997), is here confirmed. These authors gave to this datum a stratigraphic explanation, and placed FO and LO of four selected ichnotaxa. The possibility that this ichnofaunal reduction is based on the extinction of the trackmakers is unlikely, because of the short time of deposition of the sediments in the Collio Basin, and the finding of an almost complete association in the younger Monte Luco and Tregiovo Fms.

A more convincing hypothesis is the paleoenvironmental one. The distribution of facies supposed by Ori et al. (1986) is here confirmed, and corresponds to changes in the ichnoassociation. The lower-medium part of the Pian delle Baste member is characterized by sand-sheet environments, the ichnoassociation is diversified and *Amphisauropus*-dominated. The medium-upper part is instead characterized by proximal- to distal- floodplain and lacustrine environments, the ichnoassociation is reduced, *Dromopus*-dominated with amphibians tracks. The upper pelitic part of the Val Dorizzo member is characterized by distal- floodplain to lacustrine environments, the association is reduced and *Dromopus*-dominated, with *Erpetopus* and amphibian tracks. The specimens classifiable as *Erpetopus cassinisi* come from this last unit.

The invertebrate ichnoassociation is well-diversified and includes: *Acripes cf. multiformis, Planolites, Cochlichnus anguinensis, Cruziana cf. problematica, Diplichnites gouldi, Diplopodichnius biformis, Paleophycus tabularis, Paleohelcura tridactyla, Circulichnis montanus, ?Scoyenia, Rusophicus, Medusina limnica,* and *cf. Medusina atava* (Contardi & Santi, 2009, Avanzini et al., 2011).

The association, coming mainly from the Val Dorizzo member, was attributed to the Scoyenia ichnofacies, and is characterized by a predominance of arthropod traces. This would indicate low depositional energies and repeated subaerial/subacqueous transitions (Minter et al., 2007).

Fossils from this member include the freshwatwer bivalves Anthracosidae, and the crustaceans *Estheria* (Curioni, 1870, Berruti, 1969, and Conti et al., 1991). The fossil plants, found mainly in the upper part of the Pian delle Baste member, include pteridosperms and conifers (Geinitz, 1869, Remy & Remy, 1978, and Visscher et al., 2001). The fossil palynomorphs gave a Late Artinskian-Early Ufimian age (Clement-Westerhoff et al., 1974, Cassinis & Doubinger, 1991, 1992).

7. Val Caffaro (Collio Basin, Collio Fm.)

The Val Caffaro site is located in the central-eastern part of the Collio Basin, in the Val Caffaro and Val Dorizzo (Brescia province), on the east to the Val Trompia site. Localities have never been described, but a stratigraphic section used as a reference, was cited by Conti et al. (1997), in the locality Bagolino. In this sector of the Collio Basin the Early Permian succession is complete, and the Collio Fm. reaches its maximum thickness.
The material was recovered in a conspicuous survey in 1987-1989, but specimens were never described or figured. It mainly comes from the medium-upper parts of the Pian delle Baste member, and from some levels of the Val Dorizzo member, interdigitated with the Dosso dei Galli Fm.
The association coming from the "red strata" of the Pian delle Baste Fm., in the medium-upper part of the member, lists: *Dromopus, Limnopus, Hyloidichnus, Batrachichnus, Varanopus, Amphisauropus,* and *Erpetopus.* The association is diversified, and the most common form is *Dromopus.* The amphibian traces are quite diffuse (*Limnopus, Batrachichnus*), and the traces attributed to captorhinomorphs are diversified. In the overlaying "black strata" the association is similar but reduced, and lists*: Dromopus, Batrachichnus, Limnopus,* and *Erpetopus*. Few specimens come from the Val Dorizzo member, including the ichnotaxa *Dromopus* and *Limnopus*.
Noteworthy is the specimen MBS 326, showing two long plantigrade trackways with a deep and continuous impression of the tail and trace of the belly, crossing each other, with very different locomotion speeds, probably linked to the substrate wetness (cf. *Batrachichnus*).
The specimen MBS 268/269 shows two *Amphisauropus* trackways of small size crossing each other, a *Batrachichnus* trackway in good preservation state, and traces of *Dromopus* and cf. *Hyloidichnus*.
The association from this site is complete, and lists*: Dromopus, Batrachichnus, Limnopus, Hyloidichnus, Varanopus, Erpetopus,* and *Amphisauropus* (in order of abundance).
The association is *Dromopus*-dominated, the amphibian traces are quite diffuse, and *Amphisauropus* and *Erpetopus* are scarce. This is in line with the corresponding associations of the medium-upper parts of the Pian delle Baste member of the Val Trompia site, corresponding to proximal- to distal- floodplain and lacustrine environments.

8. Valle del Chiese (Collio Basin, Collio Fm.)

This ichnosite is located in the most eastern part of the Collio Basin, in the Valle del Chiese (Valli Giudicarie, Trentino province). It includes the localities Faserno and Val Aperta.
In this sector of the Collio Basin the stratigraphy is slightly different. The Collio Fm. deposition alternates with cospicuous and common volcanic or volcanoclastic bodies, pertaining to the Dasdana Beds and to the Monte Macaone Fm. The Early Permian succession ends with the deposition of the Val Daone conglomerate, of supposed Middle Permian age (Cassinis et al., 2008, Gretter et al., 2013), passing upwards to the Varrucano Lombardo Fm.
The Faserno locality, near Storo (Trento province), was cited by Conti et al. (1997). The only ichnotaxon reported here is *Dromopus*.
The Val Aperta locality is situated north-west to the small village of Castel Condino, in correspondence of some military ruins of the World War I, on the southern side of Cima Bosco. A remarkable specimen from this locality (MUSE 7086), with optimally-preserved *Amphisauropus* and *Erpetopus* trackways, disposed in parallel locomotion, has been described by Marchetti et al. (2013). New field work interested this area, with the aim to reconstruct the ichnoassociation, fossil content and facies of this sector of Collio Basin. A stratigraphic section was measured bed-by-bed, from the base of the military camp to the top of Cima Bosco, searching for fossil footprints and sampling for sporomoph studies. Here follows a brief description of the different units:

A, C) Four wide bodies (1-20 m) of dark grey-greenish volcanic agglomerates of riodacitic composition, with angular and rounded volcanic rock fragments of the same composition (2-100 cm in size), in heteropy to upper sedimentary units of B. These volcanites probably pertain to the Monte Macaone Formation.
B) Locally, at the base of the sequence, a very fine-grained lithofacies organised in fining-upwards cycles with linguoid ripples and flute cast structures is present (B1). This lithofacies - that constitutes the base of a First World War military village - preserves scattered tetrapod footprints, sometimes associated to mud cracks and shrinkage structures. These levels probably pertain to the pelitic facies of the Val Dorizzo member of the Collio Formation. (15 m). The upper part of B is constituted by coarse sandstones and microconglomerates, yellowish-grey in color, with mono- to poly-crystalline quartz and volcanic clastics, interested by sudden and discontinuous, lateral and vertical grain changes; channeled structures are very common. Some clay chips in the sand-bodies derive from finer sediments and are consistent with the presence of non-preserved fining-upwards cycles, eroded at the top (70 m).

D) Conglomerates alternating with sandstones, deposited in fining-upwards cycles, cut by more or less pronounced canalisations. The erosive surfaces of these thin sequences are locally marked by finer, silty-pelitic sediments; clay plugs and chips of the same composition may also be observed. This latter unit corresponds to the Val Daone Conglomerate (Cassinis et al., 2008) dated to the late Artinskian up to Kazanian *p.p.* or perhaps also slightly younger (Cisuralian-Guadalupian). This interval is exposed for about 30 m.
E) Verrucano Lombardo red clastic beds of Late Permian Age (10 m).

Some sedimentary structures and coarser grain size suggest that the depositional palaeoenvironment is slightly different from the classic Collio Fm. (fluvio-lacustrine or fluvio-palustrine, Cassinis et al. 2012), while it shares similarities to the German Early Permian Rotliegend Fm. (fluviatile with tetrapod tracks), described by Haubold & Katzung (1975).
Sedimentological features of the trampled interval testify to typical fluvial deposition. Repeated lateral and vertical changes of grain size across the entire interval, the conspicuous number of deep erosive channels, and the common presence of cross-stratification/lamination structures support this hypothesis. These features probably developed in a proximal alluvial plain subject to seasonal conditions. This palaeoenvironment is different from the classic Collio Fm., where dark mudstones and siltstones with frequent laminations, expression of shallow lacustrine or fine alluvial environments in humid and anoxic conditions, prevail (Cassinis et al., 2012).
The ichnoassociation from this site lists: *Dromopus, Erpetopus, Amphisauropus,* and *cf. Hyloidichnus. Dromopus* is the most common form, but further considerations are useless because of the scarcity of material. An interesting datum comes from U-Pb radiometric dates on the volcanic Monte Macaone Fm., source of the thick volcanoclastic breccias of the measured section. In this area they give an absolute age of 283±2 Ma (CARG project, Bargossi comm. pers.).

9. Tregiovo (Athesian District, Tregiovo Fm.)

The ichnosite of Tregiovo is located in the Val di Non, on the western side of the Monte Ozol, and under the small village of Tregiovo (Trentino province). Fossil footprints here have been reported by various authors, but they were never described (Conti et al., 1997, Neri et al., 1999, and Avanzini et al., 2001). This area is situated in the central-western part of the Athesian District, the most extended volcano-volcanoclastic sequence of the Early Permian of the Southern Alps, with an average thickness of 2000 m. It is associated with plutonic rocks and has been divided in several units, some of which sedimentary. The Tregiovo Fm. represents the most extended and thick sedimentary unit of the Athesian District, and is interpreted as a moment of stasis of the volcanic activity. It has been divided into two parts, a conglomeratic-arenaceous and a pelitic unit. Radiometric dates give age-constraint to this formation (277-274 Ma, Avanzini et al., 2007, Morelli et al., 2007, and Marocchi et al., 2008).

The studied section is localized in northern Italy, and, more precisely, in the Trentino-Alto Adige region, near the small village of Tregiovo. The classic Tregiovo section along the Tregiovo and Lauregno provincial roads is now almost entirely covered by nets or walls. The new section lays in the small valley incised by the Tregiovo rill and extends from the Pescara creek (where the basal sandstones of Tregiovo Fm. outcrops) almost to the village (where the roof rhyolite outcrops), for a total thickness of about 120 m. This locality is known as "Le Fraine", term indicating frequent landslides, due to the inclination of strata in the left part of the valley. This causes loss of material from the strata, deposing in wide slab-piles.

The area was interested in mine activities (Ag and Pb-Zn) for centuries, which was probably the main cause of the birth of the Tregiovo village in the XII and XIII centuries AD. Along the section two abandoned mines are recognizable, and the mineralization is quite diffuse in strata, but this does not ruin its fossil content.

The section was measured on the right and left sides of the Tregiovo rill, sampling for sporomorphs at regular intervals (2-3 m). Several small faults and folds and also the soil cover rendered the reconstruction of the stratigraphy difficult, but the constant inclination of the strata and the recognition of different facies permitted the production of a composed stratigraphic column. Here it is reported a brief description of the stratigraphic units:

A) Thick strata (100-150 cm) of grey and brownish conglomerates and coarse sandstones, massive or irregularly stratified, with erosional base, eroded clasts and clay chips. Thinner strata (10-30 cm) of grey and brownish sandstones, with regular stratification and frequent plane bed lamination structures. The alternation of these units forms clear thickening- and coarsering- upwards cycles. These units outcrop at the base of the section and in the upper part, the deposition ends with the roof rhyolite of the Ora Fm. These strata are exposed for about 20 m.

B) Thin strata (2-5 cm) of dark-grey and black mudstones and fine siltstones, frequently organized in small banks (10-15 cm), and commonly interested by planar lamination, produced by the hydraulic selection. The sedimentation is monotonous, lateral and vertical changes of grain size and thickness of strata are not observed. These intervals are characterized by abundant plant remains (vegetative and reproductive organs, charcoal) and tetrapod tracks (*Dromopus*).

On the surface of the various horizons we recognize arthropod traces, invertebrate tunnels, root traces, mud cracks, syneresys cracks, tool marks and flute casts. The lower part of the interval is less fossiliferous and bioturbated, and strata are thinner.

Quartz, Ag and Pb-Zn mineralization are diffuse, these last ones form star-shaped or ovoid sulphide nodules, concentrated in specific layers and variably aggregated. These nodules are characterized by internal radiate and concentric structures, the size is variable (2-20 cm), as well as the shape.

Small faults and folds are quite common and disturb the stratification, the thin and brittle strata frequently form kink-fold structures. The thickness of this interval is about 80 m.

C) Thin strata (3-5 cm) of brownish limestones and mudstones, organized in compact banks of 50-100 cm. Planar and convolute laminations are frequent, and are constituted by alternations of light micrite and dark siltstones/mudstones. The presence of microbial structures is suggested by the presence of wrinkle structures on the strata surfaces, but typical grow structures are not observable. Sinsedimentary deformations are very frequent, and include convolute laminations, small bends, grow faults, water-scape structures; also a slumped interval was recognized.

In the upper part of the interval disrupted stata and intraclasts, commonly associated with oxidized horizons, testify to sinsedimentary erosion and paleosoils formation. These levels occasionally form intraclastic breccias, with flat clasts of 1-8 cm, indicating the direction of the paleocurrent. The interval is characterized by pervasive chert mineralizations, dark grey in color, forming beds, veins and nodules. These levels are very variable in thickness (0.3 - 3 cm) and extent, both laterally and vertically. It is not clear if this mineralization is linked to an early diagenesis or not, the presence of reworked chert beds seems to point to an early diagenesis.

On the strata surface wrinkle structures, mud cracks, ripple marks, root traces, plant remains (vegetative and reproductive organs, charcoal), tetrapod traces (*Dromopus*, *Hyloidichnus,* and cf. *Erpetopus*), and conchostraceans are recognizable. Small faults and vertical fractures are quite common. This interval is exposed for about 30 m.

Thin sections analysis revealed: laterally-extended microbial structures, namely stromatolite-like crusts (sp. TV 1, 5), pervasive ricristallization (sp. TV 1, 7), sinsedimentary fractures (sp. TV 2, 3), load structures, namely ball-and-pillow (sp. TV 3, 5), embricated intraclasts opposing to the current (sp. TV 6), fine hydraulic selection (sp. TV 1), alternation of micrite and pelite levels (sp. TV 3, 5), and chert ricristallization (sp. TV 2, 5).

Facies analysis on macro- and micro- sedimentary structures indicate quite and monotonous sedimentation in the lower- to medium- parts of the section, with repeated flooding and anoxic conditions. This seems to indicate a distal floodplain to lacustrine environment, probably more lacustrine in the lower part (common bioturbation, scarce surface traces and mud cracks).
The upper part of the section is characterized by the alternation of micrite and pelite/siltite layers, with microbial structures (stromatolite-like crusts, wrinkle structures) and intraclastic breccias testifying the presence of freshwater carbonates, in an environment with stronger depositional energies. Chert mineralization is common, and could be of early diagenetic formation. The common occurrence of sin-sedimentary deformational structures and the intraclastic breccias could testify a tectonic reactivation of the basin, linked to the immediately successive alluvial fan deposition. The base and the top of the section are characterized by the deposition of medium-to coarse sandstones and conglomerates, with recognizable fining- and coarsering- upwards trends. This is typical of alluvial fan environments.
The ichnoassociation lists: *Dromopus, Hyloidichnus,* and cf. *Erpetopus*. *Dromopus* is by far the most common form, and commonly occurs in the medium part of the section (distal floodplain environment). The preservation state of these tracks is quite poor, so trackways and complete manus-pes sets are diffucult to recognize, but there are not substantial differences of this tracks to that of Collio and Mt. Luco Basins. Captorhinomorph tracks (*Hyloidichnus*, cf. *Erpetopus*) were identified for the first time in this basin, so the association is not "monotypical", as previously supposed. They occur in the upper part of the section (freshwater carbonates in a proximal floodplain environment). This datum seems to confirm the facies-related distribution of ichnotaxa, as already observed in the Orobic and Collio Basins.
Studies on invertebrate traces are in progress. These include: *Palaeophycus, Paleohelcura,* and *Scoyenia*, ichnotaxa typical of the Scoyenia ichnofacies. (M. Bernardi comm. pers.).
The plant fossils from this site are quite common. They were studied by Remy & Remy (1978), Kozur (1980), and Visscher et al. (2001), who attribute them a generic Early Permian age.
A new rich collection from the middle part of the section "Le Fraine" is now under study, the first results put in evidence the presence of abundant conifers (G. Forte comm. pers.).
Fossil palinomorphs of the Tregiovo Fm. were investigated in Cassinis & Doubinger (1991, 1992), Barth & Mohr (1994) and Neri et al. (1999), assigning a Kungurian-Ufimian? age. Well-preserved miospores from the locality of Grissian (Guncina Fm.), in a facies analogue to the upper part of this section, indicate semi-arid to arid conditions and an Artinskian-Kungurian age (Krainer & Spötl, 1998, Hartkopf-Fröder et al., 2001). Other fossil found in the Tregiovo Fm. are ostracods and conchostraceans (Cassinis & Neri, 1990).

10. Monte Luco (Athesian District, Monte Luco Fm.)

The Monte Luco ichnosite is situated between the Val di Non and Val d'Ultimo (Bolzano province), on the northern side of the Luco Piccolo, in correspondence of an extended rock debris. Fossil footprints from this site were signaled by Avanzini et al. (2007) and described by Avanzini et al. (2008, 2011). This area is in a north-western sector of the Athesian Volcanic Complex, north to the Tregiovo site. The Monte Luco Fm. outcrops extensively, and includes manily rhyodacitic lavas, and subordinate pyroclastic flows and surges, lava domes and epiclastic units. A 90 m thick stratigraphic section has been described by Avanzini et al. (2008). He distinguished three lithozones, from the base to the top, interpreted as: alluvial fan to sheet flood, lacustrine in semi-arid settings and alluvial fan environments. The Monte Luco epiclastic units have an age between 279.6±1.1 Ma and 279.6±4.5 Ma (U-Pb radiometric dates, Avanzini et al., 2007, Morelli et al., 2007, and Marocchi et al., 2008). New field work was done in order to better understand stratigraphy, facies distribution and ichnoassociation of this site. The section was measured and sampled for sporomorphs at regular intervals (2-3 m). Here follows a brief description of the units:

A) Fine grey arenites, showing cross stratification, in strata of 5-10 cm, laminated dark siltstones/mudstones in strata of 3-5 cm, disposed in thinning- and fining- upwards cycles. Occasionally, grey carbonatic levels with stromatolite-like structures and diagenetic nodules occur (15 m).

B) Alternance of grey compact carbonatic strata containing diagenetic nodules and stromatolite-like structures, in strata of 5-20 cm, and siltstones/mudstones with plane- and rarer cross- lamination, in thin strata of 1-3 cm. The grey micaceous siltstone layers preserve common carbonized plant fragments, the grey-black mudstones show tetrapod and invertebrate traces. Sedimentary structures include rain drops, mud cracks and ripple marks. Medium-to-coarse sandstones in strata of 30-100 cm, grey-violet in color, occur in the upper part of the interval (40 m).

C) Repeated sequences of grey-violet coarse sandstones with plane-parallel lamination in banks of 50-100 cm; grey fine sandstones with cross- stratification in strata of 5-10 cm; and dark siltstones/mudstones with parallel lamination in strata of 3-5 cm. A thinning- and fining- upwards trend is evident. Occasionally carbonatic levels, similar to those previous described, occur (30 m).

The ichnoassociation lists: *Dromopus*, *Amphisauropus*, cf. *Batrachichnus*, *Varanopus*, and cf. *Limnopus* (in order of abundance). The association is *Dromopus*- dominated, amphibians and swimming traces are quite common. The invertebrate ichnoassociation lists: *Cochlichnus anguineus*, *Gordia marina*, *Helmintopsis hieroglyphica*, *Palaeophycus tubularis*, and *Permichnium* (Avanzini et al., 2011). This was related to the Mermia ichnofacies, but possibly with a local meaning. The burrows are more common than the surface traces, contrarily to the Collio and Orobic associations. Studies on the macroflora in the locality of Sinnich, probably pertaining to the Mt. Luco Fm. (Morelli et al., 2007, Marocchi et al., 2008) indicate a Late Artiskian age (Fritz & Krainer, 2006).

7) DISCUSSION

The italian ichnofauna

The results of this work of revision bring us to reconsider the composition of the Italian Early Permian ichnoassociation; now we list seven different ichnogenera: *Amphisauropus, Batrachichnus, Dromopus, Erpetopus, Limnopus, Hyloidichnus and Varanopus.*

Limnopus and *Hyloidichnus* were detected for the first time in the Early Permian of Italy, confirming the presence of temnospondyls and captorhinomorphs of medium size, respectively. This datum seems to rebalance the ichnoassociation, previously characterized by the absence of predators (the only possible predator was considered *Dromopus*, Santi, 2005) and by the scarcity of amphibians (Santi, 2003; 2005).

The composition of the ichnofauna is similar in the Collio and Orobic Basins, displaying all the seven Italian ichnogenera; the ichnofauna of the small sedimentary basins in the Athesian Volcanic Complex (Monte Luco and Tregiovo Basins) is instead reduced.

We propose three possible explanations: 1) These basins are slightly younger (radiometric dates; Klotzli et al., 2003; Marocchi et al., 2008), so this reduction could have an evolutionary meaning (Conti et al., 1997); 2) These basins were too small to the formation of a stable environment and a complete fauna; 3) A strong bias due to the scarcity of outcrops. This latter is the most likely; material and exposed sections are fewer, and the presence of all the families of trackmakers of Orobic and Collio Basins (areoscelids, seymouriamorphs, temnospondyls and captorhinomorphs) simply suggest a bias.

The most distinctive feature of this ichnoassociation is the lack of the ichnogenera *Dimetropus* Romer and Price, 1940, *Ichniotherium* Pohlig, 1892 and *Tambachichnium* Müller, 1954; especially the first is very common in the Early Permian world. This could be explained with a slightly different environment, or with some physical barriers or, in the case of *Ichniotherium*, with the extinction of the trackmaker (see the works of Lucas and Hunt, 2006; Gand and Durand, 2006).

Stratigraphic meaning

The stratigraphic meaning of the ichnoassociation is important: the age-constraint from radiometric dates on volcanics at base and top of Early Permian Italian continental basins enable us to correlate this association all over the world.

The two main basins of Southern Alps developed between Artinskian and Kungurian. Dates on volcanic rocks of Collio Basin suggest an age between 283.1±0.6 Ma and 279.8±1.1 Ma (Schaltegger and Brack, 2007); dates from the Orobic Basin report ages of 288 Ma (Cadel et al., 1987); 280 Ma (Philippe et al., 1987); 279 and 270 Ma (Berra et al., 2008). The sedimentary units pertaining to this latter, covering the upper part of the basin, are probably contemporary or younger to those in the Collio Basin (Cassinis et al., 2012), so the Italian ichnoassociation is attributable to the Kungurian.

In the most recent attempt to construct a worldwide tetrapod footprint stratigraphy, Lucas (2007) pointed out the scarce resolution of this than the bone record, and recognized two biochrons in the Permian: the Early Permian *Dromopus* and the Late Permian *Rynchosauroides*. The revised Italian ichnoassociation reflects well the Early Permian redbeds ichnofaunas of USA, Germany and France, so its pertaining to the *Dromopus* biochron (which corresponds to the Collio FU -ichnofaunal unit- proposed by Conti et al., 1997 and Avanzini et al., 2001) seems acceptable; up to now further subdivisions are difficult to hypothesize.

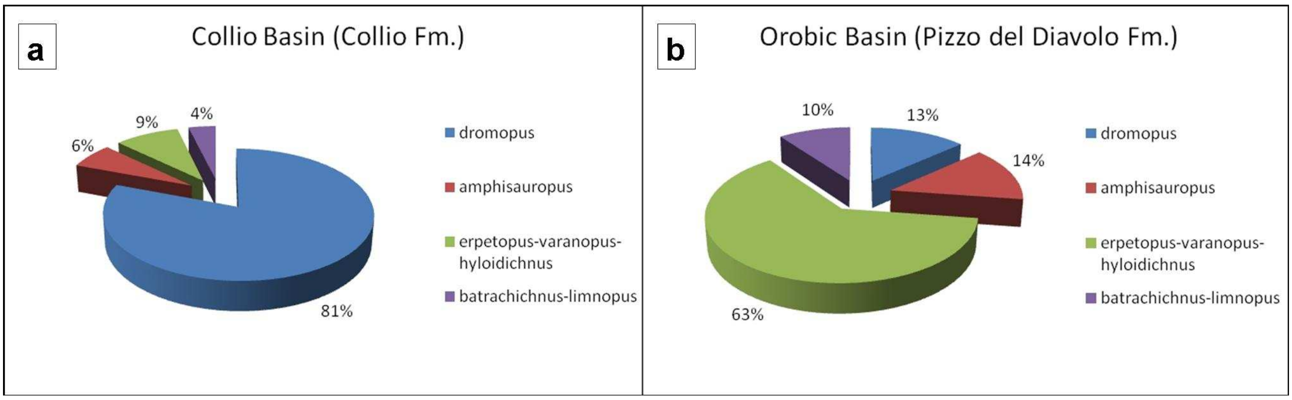

FIG 14. Distribution of the ichnotaxa related to the supposed trackmakers in the Collio and Orobic basins (Collio and Pizzo del Diavolo Fms., respectively).

Ichnofacies and paleoenvironment

The possibility to restudy all the material collected from the Collio and Orobic Basins, coming from several outcrops and not selected, enable us to do some considerations on the frequency of forms. We grouped the ichnogenera according to the supposed trackmakers (*Dromopus* to areoscelids; *Amphisauropus* to seymouriamorphs; *Limnopus* and *Batrachichnus* to temnospondyls; *Hyloidichnus*, *Varanopus* and *Erpetopus* to captorhinomorphs), following the interpretations of Haubold (1971), Gand (1988), Haubold et al. (1995), Haubold (2000), Haubold and Lucas (2001, 2003); Voigt (2005) and Gand and Durand (2006); and considered their occurrences in the basins

(209 specimens in the Orobic Basin, 420 in the Collio Basin). The most distinctive feature is the predominance of areoscelid tracks (81% of the occurrences) in the Collio Basin and of captorhinomorph tracks (63% of the occurrences) in the Orobic Basin; the distribution of the other forms is similar. These data could reflect a slightly different environment in the two basins: the Collio Formation of the Collio Basin is characterized by alluvial-to lacustrine deposits (Cassinis, 1966; 1999); the Pizzo del Diavolo Formation of the Orobic Basin comprises also playa-like deposits (Ronchi and Santi, 2003; Ronchi et al., 2005; Berra and Felletti, 2011). These could mean a more arid environment, with the reduction of areoscelids and the spreading of captorhinomorphs. Recently, after the study of several sites of New Mexico, Hunt and Lucas (2006; 2007) proposed the use of tetrapod ichnofacies, association of imprints with a great correlation value. In the Early Permian, they distinguished the *Batrachichnus* ichnofacies, subdivided into: *Ichniotherium* (inland/distal alluvial fan settings), *Amphisauropus* (alluvial plain settings) and *Dimetropus* (coastal/tidal flat settings) sub-ichnoceonosis.

Italian researchers questioned the validity and most of all the utility of these ichnofacies (Santi and Nicosia, 2008), but proposed the sub-ichnoceonosis *Amphisauropus* for the Orobic Basin and a transition between the *Amphisauropus* and the *Ichniotherium* sub-ichnoceonosis for the Collio Basin (Santi, 2008). Although the tetrapod ichnofacies present some problems and their study is at the beginning, we propose an *Amphisauropus* sub-ichnoceonosis for the Collio basin and an *Erpetopus* sub-ichnoceonosis for the playa environment of the Orobic Basin (as suggested by Hunt and Lucas, 2006, for the Castle Peak site of Texas). In this context, the absence of *Ichniotherium* and *Dimetropus* could be linked to the different ambient of deposition (alluvial-plain or playa-like, not alluvial fan or coastal/tidal flat).

8) CONCLUSIONS

From this revision study, the Early Permian tetrapod ichnoassociation of the Southern Alps is enlarged and more balanced than previously known, and it is more similar to contemporary ichnofaunas of Germany, France and United States. The ichnoassociation now comprises: *Amphisauropus*, *Batrachichnus*, *Dromopus*, *Erpetopus*, *Limnopus*, *Hyloidichnus and Varanopus.* The main difference is the lack of some widespread ichnotaxa like *Dimetropus* and *Ichniotherium*. These differences in ichnofauna could represent different basin conditions, expression of more specific and close environments or, in the case of *Ichniotherium*, a stratigraphic datum: in the Early Kungurian the trackmaker became extinct. This would be an important point of correlation with contemporary ichnofaunas less time-constrained, in this case the utility of "ichnofaunal units" (Conti et al., 1997) would be confirmed.

The association between Collio and Orobic Basins is almost contemporary and lists the same ichnogenera, but in the first case we observe a predominance of areoscelid traces (*Dromopus*), in the latter of captorhinomorph traces (*Hyloidichnus*, *Varanopus*, *Camunipes*). This datum could reflect different environments, seasonal in Collio Basin, more arid and playa-like in Orobic Basin (Ronchi and Santi, 2003; Ronchi et al., 2005; Berra and Felletti, 2011), suggesting different habitats for the two systematic groups of trackmakers.

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ICHNOLOGICAL PARAMETERS

Amphisauropus kablikae (Geinitz & Deichmüller, 1882)

Measures relative to the pes

Sp	TR/cpl	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 2	1 pII	28.9	40.6	0.71	82.67	17.6	30.3	1.64	7.7	5.7	6	13.4		4.7	4.1	5.3	4.9		16.97	11.74	60.93		72.67	
	1 pIII	52.6	42.3	1.24	56.24	28.6	27.2	1.84	9.2	15.5	18	21.5	9.4	8.8	5.4	5.9	7	4.1	6.77	22.74	24.19	23.25	46.93	76.95
	1 pV	44	33.9	1.30	64.18	30	21.9	1.47	11.8		10.3	13.5	9.1	9.7		4.7	6.2	5			25.08	19.51		91.04
CT 3	1 pII	20.5	29.3	0.70	67.07	13.1	15.2	1.56	4.7	7.1	6.3	7.3		3.8	5.4	3.9	3.3		69.83	13.83	54.64		68.47	
	1 pV	34.9	27.9	1.25	45.86	14.5	16.9	2.41	9	12	12.7		11.3	5.5				4.1	-9.47	46.58	8.78	57.38	55.36	103.27
	1 pVII	31.8	24	1.33	52.59	14.8	18.7	2.15	6.7		9.2	9.5		4.6		3.2			-18	21.03	26.2		47.23	
	3pIII	37.7	29.6	1.27	55.71	18.3	19.8	2.06	7.5	11	15.2			3.5	3.3	4.6			33.64	16.07	21.08		37.15	
CT 4	pI	23.6	25.8	0.91	60.26	13.1	22.2	1.80	8.2	10.7	10.9			5.4	4.1	8.8			17.54	19.77				
	pV	25	34.9	0.72	80.13	15.5	27.5	1.61	6.8	7.1	9.5	12.6		4.7	4.2	3.5	6.2		20.03	0	50.46		50.46	
CT 5	pI	41.5	32.1	1.29	47.55	25	24.5	1.66	9.2	11.3	16.5	14.7	11.9	5.2	4.2	5.1	3.6	2.5	11.49	0	29.65	14.85	29.65	55.99
INF 3	2pII	40.9	31	1.32		21.5	25.4	1.90		8.5	19.4				3.3	4.2				18.6	12.8		31.4	
	2pIII	40.9	34.9	1.17	50.07	17.3	28.9	2.36	7.4	14.5	21.2	15.5	6.6	6	3.5	3.9	3.3	4.7	-6.47	8.73	8.63	31.78	17.36	42.67
INF 4	pI	33.6	31.2	1.08	53.53	19.7	23.7	1.71	6	13.8	16.8	15.2		1.6	3.4	2.6	3.1		24.16	14.11	12.2		26.31	
	pIII	37.1	40.8	0.91	56.69	21.3	30.5	1.74		7.9	12.7	19.1	14.2		4.7	4.3	4.1	5.2		25.49	20.26	4.51	45.75	
INF 5	1pII	56.4	42	1.34	62.35	27.2	29.6	2.07	10.5	16.5	24.7	27.3		7.7	7.5	7.4	3.8		16.31	43.69	12.77		56.46	
	1pIII	47.3	43.7	1.08	61.85	21.2		2.23	12	19.3	25.8			6.5	4.9	9.2			11.85	13.1	11.78		24.88	
INF 9	pIII	22.6	16.2	1.40	61.31	10.6	13.1	2.13	5.5	9.2	12.4	11.6		2.2	3.2	2.8	3		5.31	18.1	12.04		30.14	
	pIV	25.4	16.9	1.50	65.56	11.6	13.4	2.19	4.9	8.6	13.8	13.4		3.6	3.5	2.8	2.6		13.78	17.27	14.04		31.31	
	pVI	25.4	18	1.41	77.91	11.3	15.5	2.25	5.7	10.5	14.8	16.2		2.8	3.2	3.5	3.7		10.18	20.73	13.62		34.35	

	pVII	32.8	18.7	1.75	47.55	14.1	15.5	2.33	4.9	7.8	11.6	16.9		4.1	2.5	4.6	2.8		29.58	0	16.04		16.04	
	pVIII	25.8	20.1	1.28	79.7	11.3	13.8	2.28	5.4	14.1	14.8			2.8	3.9	3.2		3	12.58	8.34	30.47	2.75	38.81	54.14
LI 21	p	27.9	28.6	0.98	59.74	16.9	16.2	1.65	7.7	8.8	10.9			6.6	1.9	2.8			0	18.23	34.99	25.84	53.22	79.06
MNSM 32	p	50.1	37.4	1.34	59.53	21.5	19	2.33	10.4	17.3	24.7			9	6.2	4.9			0	18.43	19.78		38.21	
UR 180	pII	35.2	22.5	1.56	47.06	14.4	15.6	2.44	6.7	7.2	20.3	20.4	5	4.2		3.7	2.5	2.7	32.03	0	9.06	49.64	9.06	90.73
PDVcII 3	p	32.1	17.3	1.86	23.96	19.4	11.6	1.65	6.1	7.1	10.6	8.8	5.5	4.2	2.5	4.9	2.4	2.8	34.75	0	20.66	9.58	20.66	64.99
PF 6	p	21.2	14.5	1.46	45	11.6	8.1	1.83	6.2	6.7	9.5	7.7		2.5	2.8	2.1			22.86	7.63	31.16		38.79	
MBG 8827	pV	11.1	13.4	0.83		6.3	7.2	1.76	3.2	3.3	4.9	4		1.1	1.8	3.9			13.51	28.29	73.2		101.49	
MBG 8829	p	45.5	43.7	1.04	71.7	27.9	26.8	1.63	16.8	17.6	18.3	15.3		8.5	9.3	8.1			8.31	19.7	27.99		47.69	
MBG 8945	p	56.6	67.6	0.84	67.24	25.9	44.9	2.19		19.8	24.1	25.3	16.2		12.7	11.4	4.8	6.1	16.91	33.03	25.99	17.22	59.02	93.15
MBG 12454	p	29.5	15	1.97	35.5	17.5	13.4	1.69	5.9	5.8	10.4	8.9		3.6	1.5	2.7	3.6		-9.65	14.68	12.18		26.86	
MBG 12529	2 pI	33.5	57.4	0.58	65.56	22.7	26.6	1.48	11.2	11.8	10.9			4.7	6	6.3			22.81	17.25	66.45		83.7	
	2 pII	50.5	47.6	1.06	44.05	29.5	26.1	1.71	15.9	17.1	15.6	18.3		11.2	7.9	5.6	4.4		60	19.01	38.22		57.23	
MBG 12533	p	43.3	58.6	0.74	58.55	25	38.9	1.73	6	10.4	16.8	22	15		5.5	6.6	4.5	5.1	30.91	25.98	17.1	32.86	43.08	106.85
CURIONI	p	73.5	55.8	1.32	59.6	31.5	43.2	2.33	15.1	26.4	43.4	44.6		10.1	14.3	9.9	10.4		14.8	18.1	21.24		39.34	
MBS 118	p	44.7	39.4	1.13	67.48	22.7	26.5	1.97	12.5	17.6	22.1	15.2		11.3	5.5	4.2	5.6		10.4	11.3	31.26		42.56	
MBS 268/269	1 pII	14.2	14.3	0.99		4.6	7	3.09	4.2	3.8			4	3.4	1.9			1.7	9.37	-8.09	41.6	51.44	33.51	94.32
	1 pIV	16.3	16.3	1.00	72.47	6.2	7.3	2.63	3.7	3.8	7.5	6.3	5.3	4	3	3.2		2.1	23.6	16.22	41.81	56.04	58.03	137.67
	1 pV	14.7	11.8	1.25	57.99	6.7	9.5	2.19	3.1	6.3	8.2			2.8	3.1	2.5			46.31	21.91				
	1 pVII	15.3	16.5	0.93	71.49				4.1	7.6	8.7			1.7	1.7	1.5			4.71	42.56	34.76		77.32	
	2 pVI	12.1	12.6	0.96	58.32	7.5	7.5	1.61	1.9	3.8	4.5		3.7	2.5	2.8	2.1		2.2	19.71	34.67				171.44
	p	19.9	11.3	1.76	55.78	8.9	8.1	2.24	3.4	5.7	7.6			5.5	2.3	2			63.37	0				
MBS 279	pIII	31.5	44	0.72	66.48				14.5	11.5	10.8	13.7		7.7	6.2	4	3.8		-22.17	19.78	27.62		47.4	
	pIV	36.9	35.2	1.05			32.5		12										19.07	19.15				
MBS 283	p	72.6	51.1	1.42	58.82	37.9	34.5	1.92	20.2	30.8	33.8	31.3	13.6	8.5	6.8	8.7	4	7	9.29	12.78	17.49	19.81	30.27	59.37
NS 43-100	1 pII	35.1	55.9	0.63	56.56	21.3	50.5	1.65	7.2	19.2			13.7	8.4	8.3			11	10.86	5.56				
	1 pIII	38.6	25.1	1.54					16.3	11.6	11.9			7.6					17.91	17.77				
	p	42.8	34.2	1.25	61.1	19	29.6	2.25	5.8	11.9	10.3	9.2		6.3	5.8	4.6	3.9		33.28	23.59	32.62		56.21	
UR 7	pII	38.2	32.3	1.18			27		17.2					6.9					9.14	11.74				

UR 9	pIII	38.6	47.4	0.81			27.1		14.4				9					5.8	18.84	19.59	12.89	80.45	32.48	131.77
UR 126	pII	36.7	49.3	0.74	61.89		33.7		18.3					9.2					7.26	12.73	39.22			
MUSE 7086	1 pII	35	36.9	0.95	63.72	15.6	24.7	2.24	19.7	24.1	23.4			5.9	8.8	6			20.33	26.73				
	1 pIII	41.5	68.6	0.60	79.35	13.7	34.9	3.03	21.5	23.5	26.4	33.2	17.7	5.2	8.2	7.4	6	6.3	30.82	30.66	26.39	36.3	57.05	124.17
	1 pIV	50	50	1.00	76.97	18.6	21.8	2.69		21.1	25.3	24.3		5.8	5.7	7	5		29.59	30.31	10.44		40.75	
ML2 2	p	60.2	61	0.99	45.88	30	45.4	2.01	13	18.8	22.5	27.4	20.9	11.3	7.1	5.9	6.6	7.1	22.29	33	0	26.18	33	81.47
av		**35.8**	**33.8**	**1.14**	**60.01**	**18.3**	**23.2**	**2.03**	**9.4**	**12.3**	**15.5**	**17.1**	**10.7**	**5.7**	**5**	**4.9**	**4.5**	**4.7**	**18.14**	**17.78**	**26.21**	**31.08**	**43.9**	**92.17**
min		**11.1**	**11.3**	**0.58**	**23.96**	**4.6**	**7**	**1.47**	**1.9**	**3.3**	**4.5**	**4**	**3.7**	**1.1**	**1.5**	**1.5**	**2.4**	**1.7**	**-22.17**	**-8.09**	**0**	**2.75**	**9.06**	**42.67**
max		**73.5**	**68.6**	**1.97**	**82.67**	**37.9**	**50.5**	**3.09**	**21.5**	**30.8**	**43.4**	**44.6**	**20.9**	**11.3**	**14.3**	**11.4**	**10.4**	**11**	**69.83**	**46.58**	**73.02**	**80.45**	**101.49**	**171.44**

Measures relative to the manus

Sp	TR/cpl	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 2	1 mI	28.2	42.6	0.66	65.59	18.7	31.8	1.51	12	12.5	11.5	8.8	10.7	8.4	7.1	5.8	3.3	3.5	2.07	6.89	42.17	46.15	49.06	97.28
	1 mVI	31.8	33.2	0.96	114.7	18.3	21.9	1.74	12.1	11.7	15.6	14.2	3.5	6.7	4.7	5.3	7.4	3	7.6	6.57	32.6	66.42	39.17	113.19
	1 mVII	27.5	47.3	0.58	77.9	16.6	29.6	1.66	7.6	8.7		5.1	8.4	8.8	6.5		6.9	4.1	18.36			33.24		102.21
	1 mVIII	32.7	33.2	0.98	97.85	15.5	22.6	2.11	8.5	11.4	7.4	7.8		4.6	6	5.2	5.1		28.07	9.99	9.22		19.21	
CT 3	1 mIII	18	28.6	0.63	75.26	11.3	20.8	1.59	4.2	6	6.4		5.6	2.5	3.9			4.7	53.32	0				125.92
	1 mVII	18.7	27.2	0.69	101.31	10.2	15.2	1.83	5.4	5.3	6.3	7.7	4.5	3.8	3.5	4.2	5.2	2.8	26.82	0	67.89	66.44	67.89	161.15
	3mII	18.3	34.6	0.53	74.74	9.5	21.5	1.93	5.2	5.4	7.1	8.8	8.5	3	2.4	3.5	5.8	4.5	43.74	26.49	17.66	39.62	44.15	127.51
	3mIII	19.4	40.9	0.47	81.63	9.9	23.3	1.96	6.4	5.5	7.4	8.1	10.6	3.8	3.9	3.5	4.4	4.4	30.52	23.87	12.86	48.52	36.73	115.77
	3mIV	21.2	42.7	0.50	81.47	10.6	21.9	2.00	10.9			10.4	9.1	3.6			7	4.7	13.15	51.52	35.62	24.58	87.14	124.87
CT 4	mIII	19	34.6	0.55	69.44	10.2	24	1.86	6.7		9.5	8.4		3.8		3.5	3.3	3.6	13.08	0	49.03	21.3	49.03	83.41
	mV	22.9	32.5	0.70	52.46	12	24.3	1.91	4.4		8.1		8.2	2.5		3.2		1.9	16.56	17.23	11.94	12.02	29.17	57.75
INF 3	1mI	37.7	65.3	0.58	110.38	21.2	23.3	1.78	12.2	14.3	16.6	12.1	16.3	6.4	6	9.2	7.5	5.6	7.76	22.81	21.44	64.72	44.25	116.73
	1mII	32.5	47.6	0.68	90	16.9	31.8	1.92	10.5	13.2	18	13.9	9.2	4.3	6.2	7.4	8.6		32.83	11.28	18.25	64.18	29.53	126.54

	1mIV	34.6	38.1	0.91	74.93	20.1	34.9	1.72	8.5	17.6	14.8			10.6	9.5	6.4			23.55	15.58				
	2mII	26.8	51.2	0.52	102.94	17.3	33.9	1.55	14	9.2	10.2	11.8	8.1	5.1	5.1	6.8	4.6	5.6	44.19	0	17.3	41.59	17.3	103.08
	2mIII	27.2	41.6	0.65	58.78	17.3	32.8	1.57	7.8	8.3	9.5	7.1	5.7	3.8	2.8	4.2	4.3	2.5	6.75	42.01	33.44	26.95	75.45	109.15
	2mIV	22.6	32.8	0.69	71.57	11.6	25.8	1.95	8.1	8.5	12.7	8.9		4.9	4.4	4.6	4.6		8.94	9.3	10.14		19.44	
INF 4	mIII	27.7	43	0.64	70.23	18.4	27.3	1.51	8.3		9.7	13	6.9	6.5		4.9	3.9	5	4.48	27.66	27.61	41.74	55.27	101.49
INF 5	1mIII	45.9	51.2	0.90	52.38	30	34.6	1.53	10.8	15	16.2	18.2	8.9	14.5	7	8.5	7	7.7	11.68	27.87	32.37	44.01	60.24	115.93
INF 9	mI	18	21.2	0.85	75.96	9.5	12.3	1.89	5.3	5.2	8.5	8.8	6.8		2.5	2.8	2.8		13.27	23.79	28.63	25.66	52.42	91.35
	mII	16.2	20.8	0.78	50.71	8.5	13.4	1.91	3.8	6	7.1	9.1	8.7	1.8	3.8	3.9	3.5	3.5	15.89	48.12	13.94	39.2	62.06	117.15
	mIII	19.4	21.2	0.92	74.74	9.9	17.6	1.96		7.1	8.1	9.3			3.9	3.2	2.1	2.2	47.97	-6.84	27.26	33.16	20.42	101.55
	mIV	16.2	25	0.65	66.8	7.4	15.5	2.19	4	6.1	8.8	10.5	7	2.5	4.6	3.5	4.9	3.3	21.92	28.3	13.85	37.26	42.15	101.33
	mV	14.8	19	0.78	75.07		13.1			7.1	9.2	9.3	5.9		3.3	3.9	3.6	3.9		8.37	18.18	35.24	26.55	
	mVI	14.5	26.8	0.54	77.68	7.1	12.7	2.04	6.3	7.7	7.8	11.4	8.5	4.6	4.1	3.5	3.5	2.8	62.88	16.53	35.5	41.57	52.03	156.48
	mVIII	19.8	21.9	0.90	50.19	10.6	11.3	1.87	4.2	6.1	6.4	9.6	6.8	3.6	4.6	4.6	3.5	3.3	30.16	49.81	8.16	53.54	57.97	141.67
LI 16	m	24.6	25.8	0.95	67.07	17.6	24.3	1.40	9.2	7	8.1	11.2	6	6.4	5.2	7.1	5.1	5.8	-22.24	33.27	19.15	36.97	52.42	67.15
MSNM 32	m	32.5	54	0.60	68.62	18.7	39.2	1.74	7.9	11.6	13.8	15	6	11.8	8.1	6.4	7.1	4.2	11.8	0	41.67	53.05	41.67	106.52
UR 180	mI	24.7	22.4	1.10	97.87	13.5	13.4	1.83	7.5	10.2	11.8	10.1	6.2	3.3	3.7	4	3.8	3.9	22.49	16.1	26.85	81.95	42.95	147.39
	mII	17.1	32.5	0.53	84.39	12.2	20.2	1.40	5.5	7	5.6	10.7	7.2	4.7	3.1	3.8	5.2	3	-39.47	53.91	71.58	32.53	125.49	118.55
MBG 8827	mIX	8	9.4	0.85		5.7		1.40	2.2	2.5	2.8			1.6	2.6	1.6			51.13	37.84	39.57		77.41	
MBG 8829	m	41.3	45.5	0.91	67.25	21.5	39.2	1.92	12.7	13.6	19.1	23.4	12.7	8.9	8.7	7.4	8	7	-17.71	23.46	6.5	20	29.96	32.25
MBG 8945	m	39.8	70.8	0.56	80.01	19.5	39.1	2.04	13.9	17.6	20.5	26.8	23.5	5.7	10.7	11.9	12	7.3	13.49	22.62	31.58	36.23	54.2	103.92
MBG 12529	2 mI	22	57.2	0.38	81.62	12.4	43.4	1.77	8.5	7.4	13.3	8.2	7.2	4	3.6	10	5.2		45.86	23.7	-10.95	57.83	12.75	116.44
	2 mII	29.9	57.1	0.52	84.54	16.3	37.1	1.83	10.8	11.9	14.6	14.6	6.1	5.7	4.9	10.5	11.8	4.7	18.21	17.18	25.61	23.72	42.79	84.72
MBG 12533	m	34.5	38.3	0.90	83.23	21.9	22.4	1.58	5	12.8	10.2	12.5	12.2	7.4	6.4	5.8	6.9	7.6	46.62	25.94	38.47	39.22	64.41	150.25
CURIONI	m	48.5	47.8	1.01	70.91	26.4	33	1.84	11.3	16.6	22	23.3	12.3	10.6	10.9	7	4.6	11.3	8.37	15.67	26.77	17.71	42.44	68.52
MBS 268/269	1 mI	9.5	17.7	0.54	77.85	4.7	11.6	2.02	3.7	5.1	4.7	5.2	3.4	2.2	4.3	3.5	3.7	2.1	20.35	24.83	27.23	60.6	52.06	133.01
	1 mIII	13.7	15.6	0.88	83.48	8.9	11.9	1.54	2.6	2.9	5.2	5.5	3	2.3	2.3	2.7	3.6	4	35.55	0	16.72	49.44	16.72	101.71
	2 mVI	8.8	14.6	0.60	71.57	6.2	10.6	1.42	2.5	2.6	2.9	3.2	3	3.9	2.4	2.6	3.5	3.1	50.54	40.83	24.41	37.87	65.24	153.65
	2 mVII	11.6	15.6	0.74	103.68	8.4	10.6	1.38	2.7	2.7	3	4.1	4.3	2.5	1.7	1.3			51.89	0	27.76	30.69	27.76	110.34
	m	11.8	17.9	0.66	75.09	6.8	12.4	1.74	3.1	4.4	5.1	4.9	4.8	2.2	3	3.8	4.6	3.3	55.26	51.59	37.6	9.31	89.19	153.76

MBS 279	mI	26.4	40.6	0.65	76.58				15	12.7	14.1	19		7.2	8.5	4.4	5.9		9.53	32.76	47.28		80.04	
	mIII	38.5	40.5	0.95	62.14	24.6	27.3	1.57	9.7	11.2	12.5	19.1		7.2	9.7	7.6	5.8		27.19	19.66	31.48		51.14	
	mIV	32.2	38.3	0.84	79.37	12.4	27.1	2.60	9.3	14.7	20.4	20.1	15.6	4.1	6.9	5	7.4	6.5	16.21	11.51	12.55	14.74	24.06	55.01
MBS 281	m	30.1	49.1	0.61	82.52	17.9	35.5	1.68	10	7.8	10.4	13.4	9.9	6.9	7.2	4.4	7	5.3	23.37	55.82	26.69	9.02	82.51	114.9
	m	33	48.3	0.68			24.9		12.5	13.7	19.3		7.2	6.4		5.9			29.31	51.01	11.77	69.03	62.78	161.12
MBS 283	m	38.1	50.3	0.76	89	17.4	37.3	2.19	15	20.4	21.1	20.9		10.8	11.7	8.6	8.1		17.42	-5.26	53.02		47.76	
NS 43-100	1 mI	34.5	54.9	0.63	61.51	22.7	40.1	1.52	12.9	12.6	13.2	17	15.8	6.6	9.8	7.1	7.2	6.2	28.89	50.72	24.65	19.73	75.37	123.99
	1 mIII	26.4	48.6	0.54	75.81	14.9	26.1	1.77	9.7	9.6	11	13.5	15.8	4.1	4.7	8.1	5.8	3.6	53.9	44	41.3	18.58	85.3	157.78
	1 mV	23.9	35.9	0.67	81.07	12.5	29.5	1.91	7	8.9	13.2	12.5		6.7	5.4	5.1	9.1		43.8	13.08	22.53		35.61	
	2 mI	26.1	43.2	0.60	106.73				8.4	11.6	8.6	11.8		5.8	6.7	6.5	7.3		16.47	29.13	71.16		100.29	
	2 mIII	30.8	54	0.57	89.82	16.4	39.3	1.88	11.6	12.6	15.4	15.6	7.8	6.7	6.1	10.3	9.3	6.9	43.43	15.23	24.85	31.1	40.08	114.61
	2 mIV	35.9	34.9	1.03	67.03	18.5	27.4	1.94	8	16.4	17.1	20.1	11.8	4.8	5.4	5.4	9.7	5.5	29.83	15.59	10.64	14.87	26.23	70.93
	m	31.5	39.1	0.81	70.25	22.2	24.6	1.42	7.3	6.2	9.8	9.3	9.8	3.8	8.3	7.5	6.2	7	56.69	9.62	47.98	41.84	57.6	156.13
	m	31.3	40.8	0.77	68.08	16.9	28.1	1.85	6	6.9	8.5	10.5	9.4	4.2	5.9	6.4	4.9	3.8	43.54	0	6.39	31.38	6.39	81.31
NS 43-248	m	21.3	37	0.58	70.48	10.3	27.9	2.07	6.9	7.5	11.3		5.3	4.9	5.8	4.7		4.4	60.33	23.39				116.68
NS 43-249	m	27.8	51.3	0.54	93.47	16	31.2	1.74	12.5	11	10	9.8	12.2	4.4	5.2	6.4		2.2	16.55	44.14	49.58	14.39	93.72	124.66
UR 7	mI	31.7	57.9	0.55	69.07	17.3	29.8	1.83	11.2	12.6				6.2	4.8				29.52	17.64	47.2		64.84	
	mII	30	42.3	0.71	89.69	16.1	30	1.86	7.9	12.9	13.9	6.5		4.4	7.5	5.9	4.9		19.15	33.69	-20.38		13.31	
UR 9	mIII	34.8	45.7	0.76	91.8	22.1	35.2	1.57	8.4	10.9	12.2		8.7	3.5	5.9	8.1			22.64	3.61	10.06	55.83	13.67	92.14
	mIV	32.2	59	0.55	70.92	17.6	35	1.83	10.8	11.3	15.2	14.4	13	9.1	4.6	6.7	8.7	6.1	76.9	11.78	5.15	35.26	16.93	129.09
UR 126	mI	28.3	48.9	0.58	75.58	13.5	25.9	2.10	10.7	16.4	15.6	14.7	14.5	5.6	6.1	5.6	9.1	6.3	41.99	15.14	43.13	45.13	58.27	145.39
	mII	27.6	49.8	0.55	76.59	11.1	26.3	2.49	11.8	14.2			5.3	6.3	5.7			4.2	46.89	8.75	10.19	79.15	18.94	144.98
MUSE 7086	1 mI	42.2	54.8	0.77	80.85	17.8	30.8	2.37		20.9	26.4	27.3	19.6		6.8	6.5	5.4	5		13.23	38.23	35.58	51.46	
	1 mII	46.3	49.8	0.93	97.84	15.9	30.8	2.91	17.1	29.5	34.9	29.3		7	8.1	9.9	6.7		20.33	15.66	31.13		46.79	
	1 mIII	36.5	63.6	0.57	83.2	10.5	34.7	3.48	17.8	23.8	25.4	26.2	20.2	5.1	7.9	8.4	6.1	3.9	41.96	12.88	33.66	42.56	46.54	131.06
	1 mIV	48.9	52.2	0.94	87.42	23.7	27.6	2.06	15.9	22.3	26.7	23.6		6.6	4.4	7	7.3		8.43	12.59	39.16		51.75	
LUdt 9	m	44.7	55.4	0.81	64.58	24.9	35.9	1.80	14.9	17.2	19.3	22.2	17.8	13	5.4	6.8	7.3	9.9	15.75	16.6	45.11	18.62	61.71	96.08
av		**27.6**	**39.9**	**0.71**	**78.41**	**15.1**	**26.3**	**1.86**	**8.9**	**10.9**	**12.5**	**13.1**	**9.4**	**5.6**	**5.7**	**5.8**	**6**	**4.7**	**26.53**	**20.97**	**27.69**	**38.35**	**49.03**	**113.99**

min		**8**	**9.4**	**0.38**	**50.19**	**4.7**	**10.6**	**1.38**	**2.2**	**2.5**	**2.8**	**3.2**	**3**	**1.6**	**1.7**	**1.3**	**2.1**	**1.9**	**-39.47**	**-6.84**	**-20.38**	**9.02**	**6.39**	**32.25**
max		**48.9**	**70.8**	**1.10**	**114.7**	**30**	**43.4**	**3.48**	**17.8**	**29.5**	**34.9**	**29.3**	**23.5**	**14.5**	**11.7**	**11.9**	**12**	**11.3**	**76.9**	**55.82**	**71.58**	**81.95**	**125.49**	**161.16**

Measures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
CT 2	1	155.6									138.7								22.29	43.4	3.72			
		136.7								-1.58	148.1									28.8	3.27			
		138.7		135.6	55.66	50.8	129.1	90.7	176.4	-27.38	142.2		110.6	66.66	46.6	101.6	69.1	142.2	27.26	37.6	3.32	1.30	102	1.36
		145.8	155.1		56.07	86.4	131.6	94.2	172.5		156.7	144.2		71.25	96.7	104.8	69.1	135.8	28.86	36.2	3.49	2.53	114.3	1.28
		170.8		151.8	60.06	56.1	142.2	101.6	178.2	-32.47	166.9		118.2	76.32	58.6	107.2	70.2	141.5	30.36	43.8	4.09	1.31	129.8	1.32
		161.1	171.5		65.09	107.2	133.3	99.1	157.3	4.87	185.5	143.5		82.66	107.9	96.3	54	141.5	37.16	51.2	3.85	2.10	122.8	1.31
				145.5		63.1	128.1	100.2	147.5				136.3		74.4	112.2	68.4	145.7	29.64	45.6		1.51		
																			24.3	57.2				
CT 3	1	82.3	102.8		50.01	47.9	92.4	63.5	118.2	-29.36	84.2	88.5		60.62	33.9	81.8	52.9	100.9	14.97	30.5	2.84	1.34	64.9	1.27
		84.1		87.9	52.87	33.9	80.8	54.3	90.7	-20.67	86.8		81.1	63.78	48.3	64.2	38.5	88.5	0	21	2.90	1.96	62.8	1.34
		93.2	101.7		48.36	50.8	87.5	64.9	98.1	-72.72	83.3	84.1		59.13	38.5	84	48.7	105.1	11.5	32.2	3.21	1.39	77.6	1.20
		83.6		98.2	51.49	41.5	88.5	54.7	117.8	7.68	89.6		86.2	64.36	46.6	84	46.6	102.7	7.8	21.9	2.88	2.01	58.6	1.43
		79.8	91.7		51.04	39.9	81.8	52.2	114.3	-57.34	83.7	82.6		60.2	42.7	73	48.3	96	0	23.6	2.75	1.75	73	1.09
		84.2		97.3	53.47	41.6	87.8	57.9	118.2	-31.29	84.7		84	62.52	40.6	73	47.3	92.4		28.9	2.90	1.42	68.8	1.22
		76.5	92.4		44.77	44.4	79.4	50.8	102.7	-50.57	77.6	76.9		56.19	43.7	63.5	34.9	85.7	31.5	29.4	2.64	1.50		
				104.3		68.8	79.7	53.6	103				86.3		63.5	57.9	34.2	80.1	14.16	24.9		2.66		
		57.8								-57.38	58.9									33	1.99			
										6.52									38.09	20.8				
	3	157.7								-41.63	152.7									35.4	4.18			
		149.8									149.6								46.74	28.3	3.97			
		148.3								-25.1	155.9								45	30.2	3.93			

										-17.93									47.35	35				
CT 4		172.7	156			113.6	106.2	71.6	124.5	-19.09	170.4								36.53	51.6	7.11	1.10	123.1	1.40
		183.1		152.1	69.12	76.6	130.2	100.2	158.4	-12.14			121.1	92.63	88.9	82.5	58.6	100.2	42.93	70.6	7.53	1.17		
			169.9			105.8	131.2	99.5	154.9			114.8			81.5	80.1	58.9	99.8	9.19	42.1		2.22		
CT 5		146.3								-13.8											3.53			
										0														
INF 3	1	178.1	176.6		57.63	91	150.6	106.2	204.3		166.2	152.7		71.12	98.8	116.4	67.7	175.3	46.37	55.1	4.35	1.72	144.3	1.23
		167		190.9	51.29	85.7	170	121.4	215.2	-14.04	173.6		131.8	70.94	67.7	113.6	64.2	164.4	41.24	65.9	4.08	1.16	135.5	1.23
			195.9			81.1	177.8	128.8	224	-27.51		163.7			105.1	124.2	69.5	168.6	41.59	54.5		1.71		
										-17.28									28.37	70.5				
	2										159.7	131.6		75.41	70.2	111.1	66.3	156.3	6.36	54.6		0.64	112.5	
				154.6		91.7	124.9	73.7	170	-61.85	146.6		129.3	73.35	88.5	93.5	50.1	143.9	15.52	46.9		1.92		
										-50.71		116.8			57.9	100.9	67.7	138.3	10.78					
																			12					
INF 4		185.6		109.6	99.69	76.7	78.6	49.3	104.5	-2.68	181.2		112.8	97.64	78.7	80.1	50.1	108.9	45.54	46.5	5.25	1.67	135	1.37
		170.3	132.8		90.72	109.1	75.4	45.7	111.8	-8.25		128.1			102.4	77	47.6	116.2	26.16	49.1	4.82	2.15		
				105		61.1	85.3	51.6	127.5											41.7		0.73		
INF 5	1										211.1		161.1	80.07	91.4	132.6	70.6	163.3	-16.02				139	
		195.6	194.4		69.22	127	147.5	90.3	200	-78.83	211.8	167.9		84.98	119.6	117.8	69.5	169.3		56	3.77	2.20		
				140.2		66.7	123.5	69.1	173.6	-23.42			144.8		92.1	111.5	58.9	167.2	-3.65	43.5		1.83		
										-15.85									15.58	69				
INF 9		106.2		72.9	95.3	56.1	46.6	29.6	59.3	0	109.5		74.2	99.13	59.6	44.4	29.3	64.6	22.96	30.6	4.02	1.89	84.7	1.25
		116.8	70.8		98.28	50.4	50.1	32.8	61.4		109.6	69.6		100.92	49.7	49	33.5	67.7	40.16	33.5	4.42	1.49	95.6	1.22
		130.9		83.4	103.78	66.3	49.7	30.7	63.5	-2.17	125.5		72.5	108.34	59.6	41.3	24.7	63.5	24.23	33.4	4.96	1.88	77.3	1.69
		131.6	83.2		101.63	64.2	52.9	34.6	68.4	0	131.2	82.1		105.67	65.6	49	33.9	72.3	36.87	25.8	4.98	2.52	107.6	1.22
		135.5		86.6	104.54	67.4	54.3	36.3	73	-4.97	133.4		82.8		65.6	49.7	32.5	73	0	27.2	5.13	2.44		
		133.4	85.4		102.61	68.4	51.2	32.5	69.5	-9.73									30.07	25.9	5.05	1.32		
				85.8		64.9	56.1	36.7	75.1	0														
										-8.28									41.19	26.2				

UR 180		99.2		99.3	70.14	72.9	67.7	48.1	92.8	-18.06			95.4		76.9	56.6	34.5	87.4	36.87	41.4	2.82	1.81		
			67.1			26.2	61.6	36.6	91.8	-3.62									55.78	45.2		0.29		
MBG 8827		32.8	46.3		40.54	17.1	42.8	33.3	52.4		36.2	49.6		46.47	19	46	36.7	55.3		11.4	2.95	1.58	29.4	1.12
		53.4		48.1	69.56	15.6	45.2	35.6	56.5		57.1		38.6	90.04	20.2	30.9	22.6	40.5		12.3	4.81	1.46	36.7	1.46
		59.7	45.3		76.5	24	38.4	27.3	52.3	-41.53	60.9	42.3		96.04	31.1	28.3	19.1	40.8	55.05	13.4	5.38	2.06	46.5	1.28
		57.7		51.11	76.86	35.6	36.7	23.9	49.1	-56.72	55.6		39.5	92.86	29.8	26.2	17.5	37.4		16	5.20	2.04	37.5	1.54
		55.3	40.9		84.52	22.3	34.5	22.9	45.5	-10.47	58.6	36.8		108.25	25.7	26.2	16	37.1		14.6	4.98	1.64	41.8	1.32
		46.1		41.3	63.35	24	32.2	23.6	42.3	-40.08	49.2		35.3	76.18	17.3	31	21.7	39.6		13.9	4.15	1.49	34.9	1.32
		54	45.7		77.34	32.5	32.2	20.5	42	-46.71	53.6	43.6		80.24	31.8	29.9	19.1	37.2	78.53	17.4	4.86	1.85	40.7	1.33
		52.5		40.3	70.84	21.2	34.2	23.8	43.2	-21.17			39.4		21.8	32.4	22.4	42.2	74.53	16.3	4.73	1.32		
		49.7	49.6		65.24	31.2	38.8	29.4	47.9		47.7								7.08	16.9	4.48	0.92		
				40.3		18.4	36.3	25.7	46.2															
																				15.1				
MBG 12529	2	189.8	185.3		54.64	103.4	153.9	80.8	200.4	2.76	190.4	166.1		77.14	110.5	123.4	72.4	183.9	4	22.1	4.52	4.84	129.7	1.46
				221.1		78.5	207.5	147.3	243.3	-38.53			137.2		79.2	111.8	64.8	146.8	15.7	43.4		1.82		
																			26.57	71				
MBS 268/269	1										77								61.66					
		68.1	72.3		55.35	32.8	64.2	50.3	82.9	-37.17	74.6	78.2		66.36	43.5	65.4	49.9	69.8	21.06	29.7	4.51	1.28	67.1	1.01
		69.2		74	51.99	35.3	65.2	49.3	82.3	-5.86	62.3		52.2	60.68	28.1	44.1	32.3	58.1	71.18	39.4	4.58	0.80	61.7	1.12
		63.8	82.3		47.19	33.3	75	57.6	87.4	-25.07		68.2			32.3	60	47.5	84.2	49.13	32.8	4.23	1.00		
		102.6		76.1	85.07	30.1	69.6	55.2	78.6	-28.96	89.8								76.76	30.1	6.79	0.50		
			75.6			58.6	55.7	39.6	73.2	-35.75										16.9		1.73		
										-39.91									71.32					
	2										72													
		66.1	52.4		68.84	25.1	46.2	37	56.5		72.1	46.1		78.77	24.6	39	27.4	50.6	68.96	19.9	5.46	1.25	46.7	1.42
		67.2		63.5	66.79	40.9	48.3	39.3	59.1		69.6		65.5	71.76	47.2	45.1	31.3	56.9		17	5.55	2.59	62	1.08
		80	58.4		77.88	25.8	52	41.7	63.7	-12	71.3	51.5		81.76	22.3	46.7	31.3	57.2	57.14	23.8	6.61	1.01	56.5	1.42
		63.2		68.3	57.13	46.6	47.1	35.2	57.5		65		57.1	69.9	43.4	40.9	29.6	53.7	-29.02	19.2	5.22	2.34	83.1	0.76
		61.7	62.8		56.37	23.8	58	44	72.5	-20.47		56.4			28.4	48.8	37.8	64.2	45.53	17.8	5.10	1.47		

				67.6		37.8	56	42.5	71										0	20.7		0.91		
MBS 279											150.1								6.1					
		170.6		198.8	57.35	119.5	158.8	113.5	190.7	-61.63											4.99		154.6	1.10
		135.9	139.4		59.43	48.8	131.1	83.7	165.3	-3.03	116.5	112		72.8	61.6	93.5	48.8	126	-7.27	50.5	3.97	1.09	106.9	1.27
		171.4		134.6	81.75	84.7	105	70.1	136.5	-49.92			78.8		50.5	60.6	24	92.8	35.15	63.3	5.01	1.07		
			127.7			86.4	93.5	61.6	122.6	8.42									36.45	28.8		1.50		
MBS 283				219.9		191.7	107	48.1	142.2	-30.52									12.2	57.1		1.68		
										-2.25														
NS 43-100	1										164.9	128.8		90.91	102.3	77.9	81.6	108.4	31.99					
		142.9		146.1	54.02	46.1	138.2	92.5	183	-3.48	140.5		100.3	71.4	62	78.6	53.7	109.4	65.13	48.1	3.68	1.12	120.6	1.18
			166.8			96.5	135.8	99.7	174.6	-33.77	181.5	134.8		76.63	73.8	112.1	88.6	144.3	43.49	64		1.33	148	
										-21.63			156.9		107.4	113.5	88.6	137.5	51.09	41.7		1.29		
																			50.29					
	2										173.1		156	79.79	113.5	107	69.8	138.3	70.56					
										-61.25		108.2			59.3	91.1	51.1	132.2	46.08	67.7		0.44		
																			49.35					
UR 7		160.3								29.01	154.3								17.39	76.9	4.20			
										-7.04									47.45	69.3				
UR 9		153.7		218.1	43.24	95.5	195.6	158.8	232.4												3.98			
			194.6			57.9	185.9	148.3	236	-10.39	160.3	166.7		57.03	84.1	143.8	101.9	193.3	15.72	28.4		2.50	114.8	
										-29.55			168.5		75.7	150.4	104.6	205.7	55.65	54.4		0.70		
																			-1.72					
UR 126											152.4								44.3					
										-9.67									33.85	68.1				
MUSE 7086	1	191.7		151.7	70.66	75.5	134.9	77.6	145.3	11.33	189		144.1	69.17	59.4	130.1	68.9	166.6	53.14	58.4	4.55	1.15	146.8	1.31
		204.7	177.9		79.54	117	131.6	63	147.6	8.74	218.5	183.8		81.77	117.6	127.6	66.1	162.7	37.11	45.4	4.86	2.58	157.1	1.30
				137.9		87.3	117.3	41.8	139.9	18.87			148		91.5	117.1	61.6	153.8	44.58	55.8		1.60		
										5.92									43.6	62.1				

av		**116.7**	**111.23**	**113.9**	**67.9**	**62**	**91.9**	**62.4**	**116.5**	**-20.79**	**121**	**103.9**	**101.4**	**77.33**	**63.12**	**79.6**	**50.5**	**107.7**	**32.24**	**38.35**	**4.36**	**1.60**	**91.5**	**1.28**
min		**32.8**	**40.9**	**40.3**	**40.5**	**15.6**	**32.2**	**20.5**	**42**	**-78.83**	**36.2**	**36.8**	**35.5**	**46.47**	**17.3**	**26.2**	**16**	**37.1**	**-29.02**	**11.4**	**1.99**	**0.29**	**29.4**	**0.76**
max		**204.7**	**195.9**	**221.1**	**104.54**	**191.7**	**207.5**	**158.8**	**243.3**	**29.01**	**218.5**	**183.8**	**168.5**	**108.34**	**119.6**	**150.4**	**104.6**	**205.7**	**78.53**	**76.9**	**7.53**	**4.84**	**157.1**	**1.69**

Batrachichnus salamandroides (Geinitz, 1861)

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
v 7052	pIII	11.8	16.6	0.71	67.28	6.3	9.8	1.87	4.7	4.8		8		1.9	1.3		1.5		29.21	28.02	34.68		62.7	
	p	8.6	11.8	0.73	71.22		5.8		2	1.9		4.2	2.4	1.3	1.2		1.2	1.2	26.09	58.94	46.49	48.57	105.43	180.09
VS 6	1 pIII	12.3	11.2	1.10	67.1	5.7		2.16	3.8	4.6	5.2	7.3		1.5	1.9	1.9			16.65	24.36	26.35		50.71	
	1 pV	15.3	9.9	1.55	61.91	6.3	6	2.43	5.5	5.6	6.9	8.6		1	1.9	1.9	1.3		5.96	23.28	29.84		53.12	
	1 pVI	9.8	13.5	0.73	59.47				5.2	4.6	6.2			2.1	1.4				29.04	42.74	32.86		75.6	
	1 pVII	13	11.3	1.15	58.3	6.9	5.8	1.88	7.7	7.2	7.3	6.4	3	1.4	1.8	1.4		2.8	19.92	12.48	7.56	75.45	20.04	115.41
	1 pVIII	10.7	11.6	0.92	42.25		4.2		6.4	5.4				2					35.12			66.94		
MBS 268/269	3 pI	15.7	10.2	1.54	36.87	7.4	5.4	2.12	5.2	3.4	6.6			5.4	2.7	2.4			25.14	54.62				
	3 pIII	15	7.2	2.08	44.16	6.7	5.1	2.24	3	4.6	8			2.9	2.1	2			15.35	41.63				
	3 pIV	15.3	10.4	1.47		4.7	9.1	3.26	2.5	4.6				3.7	1.5				42.9				19.23	
	3 pVI	16.7	9.5	1.76	56.31	8.6	7.2	1.94	3.2	7.4	7.9			2.6	3.1	2.4			16.6	32.49				
	3 pVIII	14.2	12.9	1.10	62.72	7.5	10.6	1.89	3.4		6.3	6.9		2.1		2.6	2.1				0			
MBS 326	1 pIXX	13.4	14.5	0.92	65.56	6	10.2	2.23	7.1	3.5	5.3	4.6		3.9	2.1	3.2	3.9		-4.9	0	85.76		85.76	
	1 pXX	12	13.1	0.92		7.8	8.5	1.54	1.4	3.2	4.6	4.9		1.8	1.8	3.2	2.8		0	10.1	83.19		93.29	
MBS 10921	pI	9.7	10.8	0.90	89.44	4.7	6.9	2.06	4.5	4.8	5.1	6.7		3	2.1	1.6			7.96	0	27.21		27.21	
	pII	10.7	10.9	0.98	77.91	6.2	5.8	1.73	2.8	3.5	4.1			1.2	2.2	1.3			16.14	9.75	25.86		35.61	
NS 43-103	1 pI	7.1	8.6	0.83	96.12	5	5.5	1.42	2.4	2.5	2.7	2.3		1.3	1.5	1.5	1.1		45.71	19.44	37.65		57.09	

	1 pII	6.3	6.9	0.91	75.29				2	3.4	4.6			0.7	0.6	1.4			30.77	21.04				
	1 pIII	8.6	6.9	1.25	54.78	3.5	3.6	2.46	2.2	3.6	5.3	3.3		1.2	1.6	1.6	0.9		46.43	35.8	34.82		70.62	
	1 pV	9.7	7.2	1.35	107.66	4.8	4.7	2.02	2.5	3.8	5.3	3.2		1.1	1.7	0.8	0.7		37.44	22.01	33.08		55.09	
NS 43-158	pII	9.8	16.9	0.58	36.06	7.5		1.31	4.3	5.4	7.7			2	2.8	2.4			24.58	3.21				
	pIV	10	22.7	0.44		5.7	8.4	1.75	6.5	6.3	9.2		5.3	2.3	1.7	2.1		2	4.77	51.93				
	p	18	11.9	1.51	54.15	9.5	8.6	1.89	6	7.1	8.9			3.7	3.1	3.1			10.55	30.55				
	p	17.2	16.3	1.06	44.05		8.6		6.1	8.8	6.2	6.9		2.6	2.2	2	2.2		13.78	41.16	26.75		67.91	
av		**12.1**	**11.8**	**1.10**	**63.27**	**6.4**	**7**	**2.01**	**4.2**	**4.8**	**6.2**	**5.6**	**3.6**	**2.2**	**1.9**	**2**	**1.8**	**2**	**21.53**	**26.84**	**35.47**	**63.65**	**58.63**	**147.75**
min		**6.3**	**6.9**	**0.44**	**36.06**	**3.5**	**3.6**	**1.31**	**1.4**	**1.9**	**2.7**	**2.3**	**2.4**	**0.7**	**0.6**	**0.8**	**0.7**	**1.2**	**-4.9**	**0**	**0**	**48.57**	**19.23**	**115.41**
max		**18**	**22.7**	**2.08**	**107.66**	**9.5**	**10.6**	**3.26**	**7.7**	**8.8**	**9.2**	**8.6**	**5.3**	**5.4**	**3.1**	**3.2**	**3.9**	**2.8**	**46.43**	**58.94**	**85.76**	**75.45**	**105.43**	**180.09**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	I W	II W	III W	IV W	div I-II	div II-III	div III-IV	div II-IV	div
V 7052	mIII	10.2	10.5	0.97	81.34	5.6	7.5	1.82	3.3	3.1	4.6	2.2	1.3	0.9	1.5	1.6	46.84	0	25.64	25.64	72.48
	m	7.2	12.5	0.58	80.17	3.8	6.3	1.89	2.8	3.3	3.4	4.4	2.3	2.7	2.5	1.7	27.42	26.33	98.3	124.63	152.05
PDVcII 7	m	13.2	10.8	1.22	79.58	8	7.8	1.65	3.3	5.8	6	4.3	1.7	2.2	2.5	2.8	30.8	23.48	27.35	50.83	81.63
VS 6	mI	5.5	7.2	0.76	77.92	2.6	4.6	2.12	2.2	2.5	3	3.4	2	1.4	0.5	0.8	41.46	0	41.63	41.63	83.09
	mII	6.1	8.7	0.70	93.64		5.8		4.1	3.6	4.2	2.5	2.1	1.4	1.7	1.2	35.79	7.45	29.36	36.81	72.6
	mV	7.5	9.6	0.78	71.54	2.8	5.2	2.68	2.7	3.6	5	5.5	1.4	1.2	1.4	1.8	52.18	9.4	25.55	34.95	87.13
	mVI	8.5	8.6	0.99	99.81	3.8	6	2.24		4.2	4.7	2.7		1	0.3	0.5		26.78	19.46	46.24	
	mVII	7.4	6.2	1.19	74.89	3.4	4.7	2.18	3.1	3.7	3.9		1	1.7	1.8		14.55	19.06			
	mX	9.1	5.6	1.63	96.12	4.7	4.6	1.94	3.2	3.1	5.1		0.5	0.5			38.29	0			
MBS 268/269	3 mII	9.8	12.9	0.76	83.65	6	12.7	1.63	3.2	4.1	4.3	2.2	2.5	3.1	3.2	2.7	4.1	7.91	8.42	16.33	20.43
	3 mIII	11	10.4	1.06	59.86	7.4	6.7	1.49	2.3	2.4	3.9	3.3	3.8	2.2	2.8	2.3	28.61	82.71	26.72	109.43	138.04
	3 mIV	11.5	13.8	0.83	82.61	6.6	10	1.74	2.8	5.2	5.3	3.3	2.6	3.1	3.8	2.5	42.01	8.82	65.74	74.56	116.57

	3 mVI	11.2	13.1	0.85	91.3	5.6	12.2	2.00	2.2	5.7	5	2.2	3.2	3.6	3.4	2.4	17.5	0	37.87	37.87	55.37
MBS 326	1 mXVIII	12.7	9.5	1.34	78.11	9.2	9.2	1.38	4	3.6	2.5	3.5	1.9	2.1	2.5	2.8	2.77	13.39	20.12	33.51	36.28
	1 mIXX	12.7	11.6	1.09	84.6	9.2	11.6	1.38		4.5	4.2	3.6		3.5	3.5	2.6		14.12	-9.19	4.93	
MBS 10921	mI	7.5	9.6	0.78	75.96	3.3	8.4	2.27	2.8	4.4	4.7	3.4	1.1	2.5	2.5	2.1	14.93	20.79	6.63	27.42	42.35
	mII	7.3	5.5	1.33	75.62	4.4	5	1.66	2.2	3.4	3.8		1.6	1.8	1.4		43.16	6.24			
	mIII	9.7	9.9	0.98	71.57	4	5.9	2.43		5.9	5.1	5.4		1.6	1.9	1.6	37.53	12.96	16.57	29.53	67.06
NS 43-103	mI	7	6.8	1.03	89.24	3.6	4.3	1.94	1.9	3.5	4.5	2.9	1.1	1.6	1.9	1.3	16.86	30.21	33.69	63.9	80.76
	mII	5.8	4.7	1.23	58.88				2.5	3.4	4.2		0.5	0.6	0.9		14.27	30.42			
	mX	11.7	7.3	1.60	56.4	3.6	3	3.25	2.1	4.8	8.4	4.9	0.8	1.7	1.3	1	55.56	26.31	36.72	63.03	118.59
NS 43-158	mIII	13.8	11.3	1.22	100.2	6.6	8.8	2.09	4.8	7.5	7.1	4.6	2.1	1.5	2.2	2.6	21.31	9.06	14.01	23.07	44.38
	mIV	16.3	9.3	1.75	80.79	9.7	7.9	1.68	3.9	5.3	7.3	4.6	3.3	2.8	1.9	1.6	6.53	23.23	18.73	41.96	48.49
av		**9.7**	**9.4**	**1.07**	**80.17**	**5.4**	**7.2**	**1.97**	**3**	**4.2**	**4.8**	**3.6**	**1.8**	**1.9**	**2.1**	**1.9**	**28.21**	**17.33**	**28.6**	**46.65**	**77.49**
min		**5.5**	**4.7**	**0.58**	**56.4**	**2.6**	**3**	**1.38**	**1.9**	**2.4**	**2.5**	**2.2**	**0.5**	**0.5**	**0.3**	**0.5**	**2.77**	**0**	**-9.19**	**4.93**	**20.43**
max		**16.3**	**13.8**	**1.75**	**100.2**	**9.7**	**12.7**	**3.25**	**4.8**	**7.5**	**8.4**	**5.5**	**3.8**	**3.6**	**3.8**	**2.8**	**55.56**	**82.71**	**98.3**	**124.63**	**152.05**

Measures relative to the trackways.

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
V 7052		40.3	47.5		45.06	12.4	45.9	37.4	53		51									11.1	3.95	0.56		
				55.6		27.9	47.9	37.1	64.7															
										-16.86									-5.64	21				
PDVcII 4											102.6	78		103.42	70.3	33.5	25.4	41.8						
		112.2		49.5	108.43	34.8	34.9	23.5	45.6	-8.16	105		51.3	100.3	32.2	40	25.7	48.8	-17.8	22.1		1.52	70.3	1.60
			86.3			77.5	38.3	26.9	46.7	4.18		83			72.8	40	25.4	47.9	1.67	19.7		3.81		
																			-13.21	15.1				
VS 6	1	84.4										49.4			36.3	33.2	22.9	37.4	14.04	13.4	6.91	1.35		

											75.3								-9.04	14.1				
		71	50.6		76.57	27.5	42.7	30.3	58.9	-43.53											5.81		50.8	1.40
		63.5		62.9	63.5	43.4	45.2	32.8	59.6	-72.47	66		60.7	75.27	47.3	38.5	27.5	45.5	-20.92		5.20		50.4	1.26
		66	50.6		66	19.8	46.9	36.3	61.4	-23.5	62.2	45.6		67.6	18.7	41.6	30.7	48	5.44	18	5.40	1.07	47.3	1.40
		64.6		66.6	64.2	46.2	48.3	38.8	63.9	-59.04	62.8		63.1	66.35	43.7	45.9	36.3	50.1	-17.45	16.9	5.29	2.66	48.7	1.33
		68.5	50.6		69.71	18	47.3	37.7	62.8	-15.04	70.3	49.5		73.09	19	45.5	36.7	50.1	-12.2	14.5	5.61	1.28	49.4	1.39
		73.8		66.3	75.61	50.1	43.4	34.2	54.3	-60.26	72		66.1	74.9	50.8	42.3	34.9	49		15.5	6.04	3.25	51.2	1.44
		74.8	52.2		75.97	23.6	46.9	37.4	54	-26.57	73.8	49.9		75.25	21.2	45.2	37.4	51.2		16.2	6.12	1.38	55.4	1.35
		75.8		67.5	74.99	51.2	44.4	34.2	54.7	-21.8	75.2		67.7	76.89	52.6	43	35.6	48	25.11	13.8	6.20	3.76	45.9	1.65
			56			24.3	50.4	41.6	61.7	6.71		51.6			22.6	46.2	41.6	50.8		15.2		1.54		
																				13.4				
MBS 268/269	3	73.9								-88.25	66		51.8	80.29	37.9	35.2	22.4	47	35.2	33.8	4.80	0.56		
											72.8	51.1		85.33	27.8	42.5	32	53.1	26.32					
		89.1		75.8	76.93	52.6	54.6	40.3	71.9	-68.05	82.1		56.1	90.2	44.5	34.2	23.5	43.9	34.91	27.3	5.79	1.78	58.1	1.53
		80.8	66.2		68.93	36.6	55.3	44.5	70.3	-61.51	88.1	59.6		82.33	36.4	47.2	33	54.4	20.22	19.8	5.25	1.84	63.9	1.26
		68.1		75.8	57.46	44.3	61.5	48.6	72.6		75.4		73.3	72.05	51.6	52.2	37.9	58.3	8.47	17.2	4.42	2.79	60.4	1.13
		60.5	64.2		57.41	23.8	59.8	47.1	72.1	-61.48	53.3	52.3		65.34	23.8	46.3	33	56.2	23.47	26.3	3.93	0.90	52.2	1.16
		61.1		61	63.45	35.6	49.4	37.2	60		63.7		46.2	80.84	28.4	36.6	26.1	46.6	15.28	24.5	3.97	1.31	46.7	1.31
		68.5	54.9		63.37	25.5	48.6	34.5	64	0	71.7	51.5		83.1	35.1	37.4	22.9	47.8	12.47	19.7	4.45	1.54	60.3	1.14
				72.4		42.1	58.6	45.6	80.8	-38.03			56.6		36.2	43.3	27.4	56.8	48.6	26.7		1.47		
										-37.39									21.37	25.6				
MBS 326	1	88.7		58.4	106.87	52.2	25.8	18.7	32.1	21.09	100.4		83.5	92.21	73.4	38.8	28.6	49	-10.26	30.3	6.98	2.07	99.8	0.89
		90	52.7		96.48	35.3	39.2	31	47.6	-11.52	62.5	49.9		71.85	23.3	43.4	32.5	54	-14.04	50.1	7.09	0.58	77.9	1.16
		77.3		67	84.8	54	38.1	27.5	49.4	7.2	81.6		55	91.84	36	42.3	30	50.8	-8.35	41.2	6.09	1.09	71.6	1.08
		74.8	45.9		84.12	24.3	38.1	28.9	47.3	5.46	85.7	58.8		94.44	44.8	37.4	27.9	46.9	18.91	22.6	5.89	1.53	73.7	1.01
		97.1		63.9	106.2	50.8	38.5	27.5	50.1	8.24	84.2		57.9	92.89	40.6	40.6	38.2	51.2	7.33	44.8	7.65	1.02	78.7	1.23
		94.4	57.7		100.18	44.8	34.6	20.8	46.2	-25.38	87	59.3		87.98	40.2	43.7	32.3	55.7	9.08	32.5	7.43	1.31	73.5	1.28
		96.7		66.7	104	55.4	35.3	24.7	46.9	-2.86	95.1		57.6	93.54	49	42.7	28.6	57.5	-3.93	32.6	7.61	1.60	77.1	1.25
		98.5	57.4		103.3	41.6	39.5	30.3	51.2	-10.13	94.9	65.1		94.68	45.5	46.2	34.9	59.6	-18.27	25.9	7.76	1.68	79.2	1.24

		96.9		69.6	100.35	57.5	36.7	25.8	49.4	-1.74	94.6		64.2	94.86	48.7	41.6	30	52.6	7.99	30	7.63	1.77	64.7	1.50
		93.8	56.7		97.44	41.6	40.9	28.9	52.6	-2.49	98.8	63.4		94.18	45.2	44.4	33.2	55.7	-5.14	21.8	7.39	1.99	81.1	1.16
		97.1		69	97.2	52.6	42.3	30.7	55.4	0	99.2		70.6	96.5	53.6	46.6	34.9	57.1	-4.33	27.6	7.65	1.92	64.2	1.51
		91	59.1		96.38	43	40.6	29.6	53.6	7.24	93.5	61.9		91.93	44.8	41.6	31	50.1	5.27	18.7	7.17	2.35	68.4	1.33
		98.5		65.3	104.38	50.1	40.6	30.7	52.6	5.4	103.4		66.3	95.73	43	50.4	41.3	58.6	0	29.2	7.76	1.59	77.8	1.27
		84.1	60.4		93.49	46.2	37.7	25.4	49.4	-24.95	91.1	77.7		84.75	61	51.9	41.2	61.7		20.5	6.62	2.61	73.7	1.14
		90.8		57.2	97.85	42	37.4	25.8	51.5	-6.02	80.8		56.4	81.1	36	43	30.3	53.3	-3.4	34.8	7.15	1.12	67.4	1.35
			64.8			48.3	43	33.9	56.8	6.36		62.6			44.4	43.7	33.2	53.3	5.49	27.5		1.69		
		90.1								0	91.4								3.42	22.9	7.09			
		93.5		61.2	91.52	39.2	47.3	34.2	63.9	-2.79	87.7		65	85.16	41.3	49.7	39.5	60.7	0	25.9	7.36	1.55	64.9	1.44
		89.7	69.1		92.54	53.6	40.2	27.9	55.4	14.31	88.6	64.6		87.32	44.8	44.1	35.6	56.1	19.19	28.9	7.06	1.70	69.8	1.29
				53.8		35.6	42	31.4	57.9	0			64.3		43.4	47.6	37	57.9	0	21		1.88		
										0									14.23	28.2				
MBS 10921		66.5		45.8	124.42	43.4	14.6	3.4	25.1	-20.92	58.2		46.1	96.35	39.8	23	13	27.1	-32.41	13.5	6.52	3.08	37.7	1.76
			28.8			22.9	17.4	6.9	26.7	15.61		31.1			18.3	24.9	13.5	29.3	19.71	10		2.06		
																			-12.19	5.6				
NS 43-103	1	45.1								-43.26	46								-21.45	14.1	5.71			
		57.6	44.9		91.27	35.4	27.1	16.8	31.9	-18.94	68.7	42.7		101.27	30.5	29.5	22.6	32.1	14.86	14.5	7.29	2.27	42.2	1.36
		39.1		35.3	74.03	22.2	27.4	19.6	33.8	-9.28	53.9		46.4	84.96	38	26.4	21	32.1		9.6	4.95	3.14	45.5	0.86
		58.4	28.6		94.6	38.9	23.4	16.7	29.3	0		31.9			15.8	27.3	22.3	38.4		25.3	7.39	1.08		
		58.3		48.6	89.95	41.7	24.9	19.1	32.5	-38.44										24.4	7.38	0.85		
		60.3	32.6		88.21	16.7	27.9	21.8	38.9												7.63			
				51.9		43.7	27.9	22.7	37.8	-30.04														
										-17.42														
		43.4	32.1		56.17	8	30.8	26.8	40	-24.1	32.9	20.2		91.36	11.9	16.4	9.7	23.9	-20.76	12.5		0.80	34.3	1.27
		36.9		43.8		28.9	32.5	28.4	39.9	-27.31			25.5		20.7	14.4	8.5	21	2.76	16.6	4.67	1.49		
										4									-2.3	8.6				
NS 43-150/158											70.9	45		109.81	37.2	25.6	11.7	33.2	3.07					
		70.2		46.6	89.91	34.7	30.9	18.5	39.9	-87.32	67.2		41.3	114.79	33.8	23.7	9.5	29	5.48	11.9	7.09	2.88	47.2	1.49

			53			34.9	39.5	26.4	48.3			38.6			33.3	19.5	6.4	26.6	-8.56	10.8		3.16		
										-89.07									-1.59	9.3				
av		**75.6**	**52.9**	**59.9**	**84.71**	**38.4**	**39.9**	**29.5**	**51.5**	**-20.19**	**77.4**	**53.6**	**58**	**87.05**	**39**	**38.8**	**28.3**	**47.3**	**3.13**	**21.4**	**6.30**	**1.80**	**61.7**	**1.30**
min		**36.9**	**28.6**	**35.3**	**45.06**	**8**	**14.6**	**3.4**	**25.1**	**-89.07**	**32.9**	**20.2**	**25.5**	**65.34**	**11.9**	**14.4**	**6.4**	**21**	**-32.41**	**5.6**	**3.39**	**0.56**	**34.3**	**0.86**
max		**112.2**	**86.3**	**75.8**	**124.42**	**77.5**	**61.5**	**48.8**	**80.8**	**21.09**	**105**	**83**	**83.5**	**114.79**	**73.4**	**52.2**	**41.6**	**61.7**	**48.6**	**50.1**	**7.76**	**3.81**	**99.8**	**1.76**

Dromopus lacertoides (Geinitz, 1861)

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 3	1 pII	24.4	19.3	1.26						5.7	8.6	10.8	7.8		1.1	1.5	0.9	2		30.12	17.39	51.53	47.51	
	1 pIII	20.7	16.6	1.25	76.11	7.5		2.76		3.6	9	12.8	6.1		1.2	2	2.3	1.4		36.46	15.83	68.12	52.29	
	1 pIV	22.9	11.9	1.92	46.29					4.8	6.4	11.1	5.8		1.5	1.4	1.8	2.5		23.27	22.25	66.57	45.52	
	1 pV	24.9	13.7	1.82		12		2.08		5.4	6.8	13.6	8.2		1.4	2	2.6	2.5		36.53	11.9	64.33	48.43	
	1 pVIII	21.5	13.4	1.60	57.99	13.9	10.8	1.55	4.4	3.2	3	4.7	8.1	2	2.9	1.9	1.6	1.7	0	11.24	38.09	84.53	49.33	133.86
	1 pIX	25.7	15.2	1.69	59.35	9.8		2.62		4.2	5.6	17.3	7.6		1.9	1.4	1.9	3.3		26.91	21.43	50.57	48.34	
	1 pX	22.4	18.5	1.21	60.64	12.7	12.4	1.76	7.3	5.3	5.1	6.6	5.4	2.7	3.5	3.7	2.6	1.6	29.58	34.61	55.78	84.51	90.39	204.48
	1 pXI	17.6	13	1.35	57.99	7.5		2.35		4.4	6.3	10.8	4.8		1.3	1.2	1.6	1.5		20	12.38	74.52	32.38	
	1 pXII	21.2	13.5	1.57	56.83	11	6.8	1.93	3.1	4.3	5.4	8.1	7.3	2.1	2.5	1.9	2.3	1.8	68.53	15.01	23.52	97.65	38.53	204.71
	2 pI	16.1	15.2	1.06		10.2		1.58	5.6		5.9	10.5	3.9	1.7		2	2.4	1.4			68.88	19.09		
	2 pII	19.3	15.6	1.24	46.51	8	8.3	2.41		4.9	5.9	11.6	4.6		2	1.4	1.5		56.2	10.87	25.69	61.1	36.56	153.86
	2 pIII	16.8	10.3	1.63	63.43	6.6	5.9	2.55		3.4	6.6	10.9	5.9		1.1	1.5	1.8	1.8		8.12	11.62	24.94	19.74	
	2 pIV	20.5	13.7	1.50		11	6.8	1.86		4.6	4.6	9.3	9.4		1.4	1.9	1.2	1.8	107.86	0	33.41	70.94	33.41	212.21
	p	16.3	13.5	1.21	54.1	11.3	7.8	1.44	2.9	2.9	2.4	6.7	8.3	1.8	2	2	1.6	1.5	7.92	0	46.59	45.43	46.59	99.94

CT 4	1 pII	32.7	14.7	2.22	51.82	17.6	9.7	1.86		7	6.4	15.5	5.5		3.7	1.9	1.7	2		13.05	20.93	96.75	33.98	
	1 pIV	28.8	17.8	1.62	62.35		12.9			6.8	7.8	13.4	7.2		3.7	3.9	3.3	3.2		0	46.98	62.88	46.98	
	1 pV	28.4	21	1.35		8.6		3.30	2.9	8.4	12.7	13.3	7.7	1.9	2.1	1.7	2.7	2.8	23	32.9	29.26	73.12	62.16	158.28
	1 pVI	35.4	17.1	2.07						8.6	14.4	11.7	7.6		2.2	2	2.6			7.44	4.29	131.89	11.73	
	1 pVIII	32.2	19.5	1.65	44.09	16.1		2.00		8.2	9.7	17.1	11.3		2.6	2.2	3.4	2.7		5.29	26.98	19.82	32.27	
	2 pI	24.2	16.1	1.50	45.08	13.9	8.5	1.74	2	6.2	7.3	12.7	4.3		1.4	1.8	2.3	2.4	39.4	13.7	44.53	55.4	58.23	153.03
	2 pII	23.4	19.8	1.18						5.5		16	7.1		2.1		1.7	2.7				51.03	49.09	
	2 pIV	24	22	1.09	52.13	9.3		2.58		6.3	8.1	14.9	6.4		2.2	1.9	1.7	1.9		47.11	14.78	56.13	61.89	
	3 pII	26.2	20	1.31	59.74	9.7	5.9	2.70		9.2	10.3	15.8	5.8		1.9	2.5	2.1	1.7		28.11	14.16	71.38	42.27	
	3 pIV	18.6	19	0.98	70.35	6.3		2.95		5.3	5.6	11.9	5.3		2.6	1.7	3.1	1.9		38.15	13.07	62.55	51.22	
	4 pI	20.5	19.5	1.05	59.74	8.1	8.6	2.53	2	5.6	6.3	13.9	8.8	1.4	2.2	1.4	2	2.1	67.52	24.86	25.62	53.22	50.48	171.22
	4 pIII	21.8	19.8	1.10	51.34	9.5	10.2	2.29	2.5	6.6	6.4	13.1	8		2.1	3.1	2.9	2.5	32.64	17.14	46.99	43.15	64.13	139.92
	p	28.8	17.6	1.64	54.07					7	10.8	9.1	7.1		2.5	2.4	2.1	2.8		31.03	22.56	94.15	53.59	
	p	17.3	19.3	0.90	52.41				2.9	10.9	12.5	12.7		1.9	2.2	1.7	2.4		65.85	17.02	38.92		55.94	
	p	18.8	12.5	1.50	65.56	6.3	6.4	2.98		4.5	7.8	12	3.6		1.4	2	1.5	1.7		31.37	26.24	100.01	57.61	
CT 7	p	21	17.8	1.18	45.1		5.7			4.6	5	9.6	6.3		2	2.4	1.9	2		54.16	25.6	77.26	79.76	
INF 6	1 pIV	34.5	29	1.19						11.3	9	13.6	6.4		3	2.4	1.7	2.4		35.84	49.43	54.98	85.27	
	1 pV	41.5	25.9	1.60	52.55					8.6	11.3	20.2	6.5		2	2.7	1	1.2		19.08	40.72	74.1	59.8	
	1 pVI	31.2	14.2	2.20	53.45	12		2.60		6.3	7.1	16	5.3		1.9	1.5	2	2.2		20.63	38.52	64.74	59.15	
	2 pI	35.2	23.7	1.49	70.92		14.4		8.9	7.3	6.3	15.2	6	1.4	2.7	1.7	2.5	1.8	-10.74	2.33	37.92	103.63	40.25	133.14
	2 pII	24.4	18.5	1.32						6.6	14.6	21.4			1.9	2.2	1.7			15.76	29.54		45.3	
	2 pIV	25.6	17.9	1.43	51.51					8	13.2	15.9			1.7	2.4	1.6			27.34	30.53		57.87	
	3 pI	39.1	20.8	1.88	47.93		11.5		7.8			16.5	6.4	2.7			2.2	2.5				18.34		100.54
	3 pII	44.4	22.4	1.98	53.09	21.7	11.7	2.05	6.6	5.8	8.1	17.9	14.3	4.1	2.2	2	3.3	2.7	8.45	18.35	30.22	85.08	48.57	142.1
	3 pIII	19	29.1	0.65	68.47		19.3		5	7.4	5.8	15		2.5	2.9	2.9	1.8		-35.63	28.14	44.37		72.51	
	4 pI	40.8	20.2	2.02	57.27					9.2	6.8	14.1	9.3		2	1.7	3.1	2.2		0	38.89	92.82	38.89	
	4 pII	39.6	17.6	2.25	49.1	18.1	8.5	2.19	5.4	5.2	12.2	20.4	5.6	2.4	2.4	1.4	2.3	4.2	21.15	24.63	37.81	67.03	62.44	150.62
	4 pIII	31	16.6	1.87	58.45	15.2		2.04		6.6	7.8	14.2	8.2		2	1.5	2.7	4.4		16.93	35.84	53.34	52.77	
	4 pIV	43	14.6	2.95	60.29					8.9	11	18.9	8.3		1	1.2	1.7	2.9		9.12	20	95.74	29.12	

	5 pI	28.4	22	1.29	56.88						15.1	22.5				3.7	4.4				27.52			
	5 pII	27.8	15.9	1.75	44.63						12	20.8				2.2	1.5				16.68			
	5 pIV	27.6	21	1.31	63.43						12.5	23.2				2.4	2.3				26.98			
	6 pI	27.8	25.7	1.08	51.34	11.9		2.34		10.6	13.2	14.7	6.1		3.2	2.5	1.3	2.5		32.55	16.64	46.56	49.19	
	6 pII	32.2	20.2	1.59		14.7		2.19			10.5	19.7	7.4			3.9	2.3	2.1			29.32	47.11		
	6 pIII	27.4	30.1	0.91	63.35	13.9	15.7	1.97		2.8	6.9	14	12.4		1.4	2.2	3.2	2.1		68.06	27.24	43.71	95.3	
	7 pI	39.6	19.6	2.02	65.54		11.9			8.5	8	13.4	10.4		3	2.5	3.1	1.9		-6.66	34.64	110.07	27.98	
	7 pII	32.5	20.2	1.61	48.02	9.3		3.49		5.2	11.3	21.7	9.9		1.8	2.4	0.9	1.7		36.61	12.5	41.52	49.11	
LI 17	p	38.1	31.1	1.23	45.19	12.7	13.3	3.00	5.8	10.1	11.1	23.6	6	3	3.1		3.1	2	35.94	22.83	7.67	71.09	30.5	137.53
	p	31.7	23.2	1.37	60.15	16.3		1.94		7	15	13.7	8.1		2.4	2.3	2.2	2.4		40.74	16.57	84.21	57.31	
LI 18	p	40.5	25.9	1.56						9.2	12.2		12.5		1.9	3.3		3.9	55.67	14.48	20.38	97.37	34.86	187.9
LI 19	p	34	21.8	1.56	61.94	14.7		2.31		7	8.4	18	12.6		3.1	1.7	1.3	1.7		18.27	26.95	77.96	45.22	
LI 20	pI	32.5	23.6	1.38	48.44				6.8	7.7	7.9	13.8	8.6	2.1	2	3.6	3.8	3.2	4.36	9.42	39.05	65.01	48.47	117.84
	pII	18.7	21.1	0.89	48.99		8.5		5.1	6.4	6.2	11.1		2.2	2.2	1.8	1.5		3.18	21.96	43.91		65.87	
	p	29.5	19.3	1.53	37.98					5.1	4.8	14.9	5		2.4				3.1	40.03	15.15	114.02	55.18	172.3
MSNM 27	p	32.7	20.7	1.58	57.02	15.9		2.06		13.8	15.7	18.5	12.7		3	4.1	3.8	2.2		9.53	13.76	64.3	23.29	
SV 13-25	p	20.2	15.7	1.29	62.49	12		1.68		4	3.6	10.5	3.6		1.5	2	1.9	3.2		11.08	31.54	60.8	42.62	
	p	18.5	12.8	1.45	61.65	6.8		2.72			4.8	10.7	3.3			2.3	1.3	1.3			20.5	53.32		
SV 13-28	2 pI	22	17.8	1.24	57.52					5	11.5	13.9			1.5	3.8	3.2			42.64	26.57		69.21	
	2 pII	17.4	17.4	1.00							8.6	14.6				3.5	5.2				68.03			
	2 pIII	19.7	15.7	1.25							9.1	19.4				2.8	3.9				31.6			
	4 pI	37.4	17.1	2.19	37.26					7.2	11.7	15.3			2.7	2.6	2.1			7.48	14.44	39.69	21.92	
	p	33	19.8	1.67	75.75						11.3	18.5				3.4	3.9			30.04	2.7	123.12	32.74	
UP 13	pI	32.5	23.5	1.38	48.45	11.5	9.7	2.83	5.8	6.9	8.4	18.7	11.3	1.8	1.8	2.5	3.1	1.8	65.15	11.14	25.86	102.49	37	204.64
	pII	36.2	28.9	1.25	46.1	12.1		2.99		12.2	13	21.9	13.5		3	2	2.3	3.3	30.74	31.67	15.62	77.74	47.29	155.77
	pIII	25.4	28.3	0.90	59.35	12.3		2.07		9.3	12.4	12.7	13.4		2.2	2	2.1	1.8	87.49	3.22	17.46	74.39	20.68	182.56
	p	40.4	24.9	1.62	75.17	15	13.1	2.69		9.4	13	22.3	12.6		2.4	3.7	2.7	2.4	34.59	14.1	29.14	76.45	43.24	154.28
	p	30.1	28.7	1.05	56.3	11.3		2.66		7	12.4	19.3	13.6		1.8	2.6	1.9	1.9		17.48	19.09	53.31	36.57	
UP 14	1 pI	20	8	2.50						4.6	6.4	6.3			1.1	1.8	1.2			6.45	14.69		21.14	

	1 pII	20.2	10.5	1.92	37.22					6.6	11.8	12.7			1.5	1.6	1.5			17.14	11.78		28.92	
	2 pI	18.4	10.6	1.74	46.27					5.6	6.9	10.3			2.3	2.5	2.9			16.91	18.91		35.82	
	2 pII	18.5	11.4	1.62	42.73					6.6	9.3	12.1			2.7	2	1.4			7.59	24.17		31.76	
PG	p	22.4	13.6	1.65							11.6	14.2				2.5	1.9				14.92			
	p	21.4	12.5	1.71							11.9	18.6				3.6	2.8				21.83			
MBG 12466	pI	38.4	27.3	1.41	37.63	19.5	11.3	1.97		12.8	15.5	24.5	12.8		4.8	3.4	6.1	1.7		36.43	22.16	51.49	58.59	
	pII	28.8	26.9	1.07	79.83	12.4	12.3	2.32	2.7	6.2	9.6	19.2	10.5	2.6	2.2	2.2	2.2	2.4	3.84	27.75	27.23	56.45	54.98	115.27
MBS 258/259	pIV	37.3	25.2	1.48							15.6	31.1	11.9			2.2	2.1	1.6			26.88	61.54		
	pV	33.4	33	1.01	57.65					14.6	10.5	23.7			1.6	2.9	2.5			17.2	37.68		54.88	
MBS 278	pIII	53	32.3	1.64							23.9	44.6				3.9	7.5				12.9			
	pIV	36.9	18.5	1.99							15.6	30.5									10.81			
MBS 310	p	41.7	43.5	0.96	92.97	14.2	22.2	2.94		14.7	14.8	28.4	13.9		6.3	5.3	5.1	2.2		15.77	48.21	91.93	63.98	
MBS 311	p	67.3	52.6	1.28	76.59	13.9	23.2	4.84		21.1	14.9	23.6	40.1		7.2	2.9	4	7.8		49.18	55.25	148.73	104.43	
MBS 325	p	52.7	36.1	1.46	78.25	23.7		2.22		11.3	15.9	24.5	9		2.8	4.3	6.5	3.3		44.73	28.46	87.96	73.19	
	p	25.9	53.2	0.49	68.17					14.4	19.1	27.2			3.4	3.7	4			4.65	44.68		49.33	
MBS 326	4 pI	29.6	38.1	0.78	84.99					19.7	19.8	27.6			4.2	4.9	6.8			36.51	17.76		54.27	
	4 pIV	65.3	30.3	2.16	87.62					16.6	20.5	25.8			4.2	5	6			-4.42	31.1	133.99	26.68	
	p	54.7	34.2	1.60							27.5	24.7				6	3.6				16.29			
MBS 10917	p	44.9	29.5	1.52	40.5	21.5	9.5	2.09	9.8	11	15.1	24.6	10.9		8.9	2.1	4	3.6	33.58	72.65	11.31	48.2	83.96	165.74
NS 43-111	pIII	68.2	55	1.24	44.92	29.5	16.6	2.31	20.9		17.6	30.6	24.8	3.3			4.6	8.4	88.44	14.72	33.38	66.14	48.1	202.68
	pIV	61.6	36.1	1.71								19.3	31					7.7				72.44		
NS 43-118	p	51.8	32.7	1.58	75.66	8.5	14	6.09		12.6	13.9	26.1	20.2		2.9	5.1	5.3	2.5		31.76	29.26	142.61	61.02	
NS 43-155	p	67.1	41.3	1.62	80.67					9.8	21	23.6			2.3	4.7	4.2			31.79	30.57	129.27	62.36	
NS 43-216	p	40	24.6	1.63							22.3	35.9				5.8	4.8				19.65			
	p	35.1	21.5	1.63							21.5	29.4				4.7	6.5				10.29			
UR 8	1 pII	63	26.2	2.40							19.6	33.4				2.5	3.9				12.09	89.4		
	1 pIII	66.4	19.5	3.41							18.8	26.3	8.4			3.6	6.1	3.7			9.53	92.93		
	2 pI	45.6	35.7	1.28	56.57					15.4	21	35			3.2	4.6	5.9			27.46	19.72		47.18	
	2 pIII	33.2	24.4	1.36							21.5	30				5.6	6.8				0			

UR 29	p	46.5	43.3	1.07	75.89	18.3	18.4	2.54		14.6	18.6	30.3	21.9		4.9	4.4	3.1	5.8		19.15	16.97	28.11	36.12	
UR 55	pII	66.2	23.2	2.85							13.1	13.3	23.5			3.8	3.7	3.8			67.59	93.8		
	pIII	27.8	31	0.90	71.49					11.3	11.9	27.8				3.5	4.2			2.25	30.89		33.14	
	pIV	54.1	26.2	2.06						9.5	15	14.5	8.3		2.9	3.6				13.48	8.27	126.09	21.75	
UR 122	p	39.4	28.4	1.39	48.01				7.2	11	16.3	24			2.8	4.2	3.5		45.18	47.05	18.24		65.29	
TRE 5	pII	35.4	24.9	1.42							19.6	29				6.4	3.4				26.5			
TRE 9	p	47.2	27.9	1.69	64.91	11.7	21	4.03		10.9	20.5	35.6	6.8			2.5	3.3	2.5		16.81	15.84	31.52	32.65	
TRE 101	p	43.3	28.6	1.51	53					8.3	11.9	19.3			3.6	4	2.8		58.07	36.68	9		45.68	
	p	34.9	28.2	1.24	66.95	11.8	12	2.96		5.2	15.1	23.6	12.1		2.8	4.2	2.7			4.04	34.28	41.89	38.32	
LU1 1	1 pII	42.2	31.7	1.33					5.3			17.9	6.5	2.7			3.4	2.4				73.12		149.65
	p	47.4	35.6	1.33	73.17	16.9	17.8	2.80		9.6	13.4	25.6	9.2		3.6	3.9	4.7	7.1		25.6	38.97	116.76	64.57	
LUdt 8	pI	57.6	32.3	1.78	45.2	16.4	9.3	3.51	10.1	8.2		20.5	17	3.7	2.6			3.7	36.49	35.97	42.31	108.25	78.28	223.02
	pII	45.6	33.4	1.37	68.47	12.2	16.4	3.74	4.9	5.3	5	16.7	14.6	3.5		2.4	4	4.3	25	23.12	48.29	149.26	71.41	245.67
LUdt 14	p	38	25.5	1.49	61.08		5.7		7.3		7.8	20.9	6.6	3			3	2.3			50.11	95.04		228.02
ML1 11	p	39.5	32.6	1.21	81.72	14.2	17.8	2.78	9.4		7.5	18.1	14.1	4.3		2.2	3.7	4.5			55.96			172.05
ML3 2	p	39.3	25.9	1.52	30.07		10.2		7			19.8	10.5	3.9			5.6	3.9				103.96		168.82
ML5 6	p	28.7	24	1.20	58.44	13.5	8.9	2.13		8.5	7.5	18.3	9.8		2.5	2.4	2.6	1.4		25.63	40.66	62.47	66.29	
av		**33.7**	**23.3**	**1.51**	**58.36**	**13**	**11.9**	**2.54**	**6.1**	**8.1**	**11.4**	**18.4**	**9.9**	**2.6**	**2.6**	**2.8**	**3**	**2.8**	**35.24**	**22.37**	**27.28**	**75**	**49.45**	**165.86**
min		**16.1**	**8**	**0.49**	**30.07**	**6.3**	**5.7**	**1.44**	**2**	**2.8**	**2.4**	**4.7**	**3.3**	**1.4**	**1**	**1.2**	**0.9**	**1.2**	**-35.63**	**-6.66**	**0**	**18.34**	**11.73**	**99.94**
max		**68.2**	**55**	**3.41**	**92.97**	**29.5**	**23.2**	**6.09**	**20.9**	**21.1**	**27.5**	**44.6**	**40.1**	**4.3**	**8.9**	**6.4**	**7.5**	**8.4**	**107.86**	**72.65**	**68.88**	**149.26**	**104.43**	**245.67**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 3	1 mII	12.9	6.1	2.11	45					4.3	6.4	10.2								28.07	0		28.07	
	1 mIV	12.2	9.8	1.24	57.99						4.6	9.4				2	1			22.26	29.43		51.69	

	1 mVIII	14.2	9.5	1.49	41.63		6.3		4.9	3.4	3.9	8.1		1.7	1.3	1.1	1.9		-16.8	12.41	18.28		30.69	
	1 mIX	15.2	13	1.17							2.5	8.2	3.1			1.4	1.6	1.8			66.76	72.88		
	1 mX	20.8	10	2.08	55.84	10.5		1.98		3.8	5.8	9.6			2.6	1.9	2.2			10.84	29.88	102.72	40.72	
	1 mXI	17.8	9.3	1.91						3	5.4		3.2		1.7	1.4		1.6		48.37	31.11	86.99	79.48	
	1 mXII	18.3	10.2	1.79	50.38	9.5	7.5	1.93	4.6	4.4	4.9	4.2	5.2	1.9	2.2	1.4	1.1	1	24.52	12.85	18.43	86.06	31.28	141.86
	2 mI	12.9	6.9	1.87	63.43	5.9	3.6	2.19		2.5	4.2	7.5	2.8		1.2	1	2.2	1.1		45.85	17	92.88	62.85	
	2 mI	10.8	6.1	1.77	50.08					2.7	4.4	7.4			1.4	1.5	1.2			22.66	12.9		35.56	
	2 mIII	13.2	9.1	1.45	28.61	5.6	3.9	2.36	2.9	3.5	4.9	7.6	4.6	2	1.8	1.5	0.9	1.4	57.55	38.24	21.15	56.68	59.39	173.62
	m	12.9	14.1	0.91	55.72	8.1	5.9	1.59		3.6	3.2	6.4	5.2		2	1.9	2.2	1.5		34.6	24.96	61.54	59.56	
CT 4	1 mI	21	14.4	1.46	68.57	8.8	6.8	2.39		4.2	7.8	11.3	4.8		1.6	2.7	2.5	2		-6.58	39.43	95.11	32.85	
	1 mV	14.2	11.9	1.19						3.9	9.7	10.4				2.7	2.2			38.27	28.41		66.68	
	2 mI	11.2	14.6	0.77	67.62					3.5	5.9	8.9			1.1	2.7	2.7			21.2	40.6		61.80	
	2 mII	9.1	17.4	0.52						3.5	5.1	10.7			1.3	2.4	2.5			44.46	53.45		97.91	
	3 mI	11	11.3	0.97	60.64					4.2	7	8.3			2.4	1.9	2.2			26.86	27.57		54.43	
	3 mIV	10.5	10	1.05	59.04					3.6	6.8	8.6			1.1	1.5	1.8			26.22	38.86		65.08	
	4 mI	16.8	13.7	1.23	63.43	6.4	6.8	2.63	2.3	2.2	5.4	10.8	4.7	1.8	1.7	1.7	2.2	1.3	54.69	0	40.7	86.96	40.70	182.35
	4 mIII	13	11	1.18						2.6	5.2	10			1.3	2.4	2.2			56.31	35.34		91.65	
	m	14.4	10.3	1.40	41.7					3.7	5.5	8.4			1.2	2	1.4			6.66	14.98		21.64	
	m	12.5	7.1	1.76	42.4					2.6	4.2	7.6			1.7	1.9	1.9			50.46	0		50.46	
INF 6	1 mIII	24	17.3	1.39	55.68	7.8	6.8	3.08	2.2	7.4	8.1	16.6	7.1	1.2	2.8	2.5	2.1	1.2	57.77	31.55	14.81	59.39	46.36	163.52
	1 mV	18.3	15.6	1.17	65.24	8.6	8.8	2.13		3.9	9.3	10.4			1.7	3.2				19.57	30.12		49.69	
	2 mI	33.5	24.2	1.38	63.88	15.1	12.5	2.22		7.7	11.3	18.9	12.4		4.2	4.2	2.8	3.1		10.88	32.56	37.22	43.44	
	2 mII	22	20.8	1.06	46.46	10.3	9.5	2.14	6.1	9.2	9.5	13.9		3.8	2.4	3.1	2.2		48.59	7.72	54.24		61.96	
	2 mIII	39.8	26.9	1.48	47.4	17.1	15.7	2.33	7	12.4	17.6	22.4	10	3.2	1.4	1.5	2.3	2.9	5.61	0.84	30.61	60.97	31.45	98.03
	3 mI	30.3	12.5	2.42	53.36					4.1	9.3	15.3	3.4		1.2	2	1.9	1.4		9.48	17.59	92.75	27.07	
	3 mII	33.9	20.8	1.63	42.48		12		3.3	4.3	10.7	13.9	5.7	1.8		2.7	2.4	2.4	54.78	7.83	0	110.7	7.83	173.31
	4 mIII	11.7	14.1	0.83						2.9	4.4	8.2				2	2.7	1.4		46.79	27.5		74.29	
	5 mI	23.9	18.8	1.27	49.09						11.3	17.3				2.6	4.1				4.89			
	5 mII	24.4	15.2	1.61	52.07						13	18.2				2.4	1.7				18.76			

	5 mIV	32.9	17.6	1.87	66.04	11.2		2.94			12.7	19.4	6.7			1.4	2.1	2			17.03	40.67		
	6 mIII	28.3	20.8	1.36	63.27	11	9.7	2.57		8	10.7	14.3	4.9		1.8	3.2	2.3	2.4		39.12	24.37	64.9	63.49	
	7 mI	17.8	18.3	0.97	64.49					4.9	9.3	15.3			3.4	2.6	3.3			44.16	36.33		80.49	
	7 mII	28.1	14.1	1.99	35.29	9		3.12	2.4	5.5	8.1	15.7		1.6	2.6	2			52.5	64.08	2.09		66.17	
LI 18	m	32.9	22	1.50	70.66		12.5			5.7	7.5	12.5	5		4.8	3.9	3.1	2.5		46.72	50.84	94.71	97.56	
LI 19	m	28.2	16.1	1.75						4.8	6.7	7.3	4.8			1.8		1.6		19.43	5.48	113.44	24.91	
LI 20	mI	25.8	15.8	1.63	76.45					3.3	5.3	9.1	3.2		1.6	2.9	4	2.3		14.74	17.96	146.05	32.70	
	mII	13.9	18.6	0.75	64.3					5.9	5.2	11.4			1.6	1.3	2.5			5	45.9		50.90	
MSNM 27	m	30.3	10.7	2.83	31.59					6.2	10.5	9.8	4.9		2.1		2.3	1.9		38.21	-8.63	78.68	29.58	
SV 13-25	m	14	9.4	1.49	66.58	6.3		2.22			5.2	6.5	6.7			1.6	1.2	1.1		51.85	-8.13	105.43	43.72	
SV 13-28	2 mI	16.1	10.3	1.56							8.2	15.2				2.8	2.7				16.76			
	2 mII	11.4	14.3	0.80							8	12.6				3.6	3.1				55.92			
	m	13.5	16.8	0.80							9.9	15.9				3.4	3.7				29.89			
UP 13	mII	19.8	14.8	1.34	66.6					7.7	9.4	16.6			3.7	1.7	2.2			21.86	20.16		42.02	
	m	22.7	14.9	1.52	43.47					6.9	11.2	18.3			2.4	2.3	2.4			35	23.8		58.80	
PG 16	m	18.3	11.44	1.60							10	13				2	1.9				28.18			
	m	18	9.6	1.88							8.9	17.8				1.9	1.6				22.7			
MBG 12466	mII	20.9	16.4	1.27	62.91					8.7	12.2	17.2			2.8	3.6	2.7			15.65	13.52		29.17	
MBS 258/259	mV	42.5	30.1	1.41	66.65	9.7	13.5	4.38	7.8	6.9	16.3	14.8	19.2	3	3.4	2.5	1.6	2.3	17.25	46.44	47.8	91.19	94.24	202.68
MBS 278	mIII	33.9	22.2	1.53							12.4	28				5.9	4.7				25.61			
MBS 311	m	34.7	49.6	0.70	96.06	10.2		3.40		13.9	12.5	17.9	11.9		3.9	5.7	6.1	4.3		19.48	86.47	105.14	105.95	
MBS 325	m	15.8	42.5	0.37	102.26				15.2	6.8	9.7	13.8		2.5	1.8	3.8	4.4		37.21	33.85	98.98		132.83	
	m	30.9	25.9	1.19	59.17					13.4	9.1	26.7			2.1	2.5	2.1			6.48	20.22		26.70	
MBS 326	mII	32.5	38.8	0.84	66.32					26.3	24	14.8			4.1	3.9				34.92	45.63		80.55	
	mIV	57.9	27.5	2.11							20.1	32.5				3.5	5.1				40.82	153.69		
MBS 10917	m	13.5	32.2	0.42	86.35		14			10.6	8.8	14			3.6	5.9	3			41.63	92.31		133.94	
NS 43-111	mII	62.5	25.9	2.41							9	24.5	19.4				3.5	3.6			45.85	158.29		
	mIII	41.8	29.1	1.44	68.07					9.3	8.5	20.1	8		4.9	2.7	2.5			54.63	32.19	99.12	86.82	
NS 43-118	m	24.9	23	1.08	56.93					7.8	9.4	14.7			2.9	3.4	2.8			46.48	27.59		74.07	

NS 43-216	m	33.7	19.6	1.72							24.9	27.5				4.6	3.6				11			
UR 8	1 mI	37.2	20.2	1.84							15.2	29.2				4.1	4.6				28.58			
	1 mII	48.8	19.9	2.45							14.9	19.1				3	4.3				23.57	161.88		
	1 mIII	42.3	18.1	2.34							10.6	22.3	10.1			3	3.7	1.9			22.34	195.83		
	2 mI	30	17.4	1.72							12.5	22.9				4.1	2.9				10.72			
	2 mIII	26.6	15.6	1.71							13.2	22.9				3.6	4				16.34			
UR 55	mII	21.3	13.7	1.55							9.9	15.2				4.4	3.2				7.44			
UR 65	m	42.2	31	1.36	32.46	10.2	9.3	4.14	8.9	11.9			19.9	3.9	3			3.8	33.33	-15.47	105.62	135.04	90.15	258.52
UR 122	m	26.8	20	1.34	37.38					10.5	7.6	13.3			4.4	2.7	1.9			41.15	18.48		59.63	
TRE 5	mI	27	24.3	1.11							13	27.2				3.2	5.6				48.48			
	mII	17.6	35.1	0.50								18.2					2.1			50.6	43.13		93.73	
LUdt 8	mII	22.1	30.4	0.73							4.9	14	15.4			2.5	2.1	1.3			71.79	157.68		
LUdt 14	m	34.4	14.1	2.44							5.8	16.4	5.6			3.9	2	2			41.22	111.85		
av		**24**	**18**	**1.44**	**57.68**	**9.5**	**9.2**	**2.62**	**5.6**	**6.3**	**9.1**	**14.7**	**7.8**	**2.4**	**2.4**	**2.7**	**2.7**	**2**	**35.58**	**28.1**	**30.5**	**100.5**	**58.80**	**174.24**
min		**9.1**	**6.1**	**0.37**	**28.61**	**5.6**	**3.6**	**1.59**	**2.2**	**2.2**	**2.5**	**4.2**	**2.8**	**1.2**	**1.1**	**1**	**0.9**	**1**	**-16.8**	**-15.47**	**-8.63**	**37.22**	**7.83**	**98.03**
max		**62.5**	**49.6**	**2.83**	**102.26**	**17.1**	**15.7**	**4.38**	**15.2**	**26.3**	**24.9**	**32.5**	**19.9**	**3.9**	**4.9**	**5.9**	**6.1**	**4.3**	**57.77**	**64.08**	**105.62**	**195.83**	**133.94**	**258.52**

Measures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
CT 3	1	94.8								-29.78	93									15.6	4.23			
		79.4	54.8		67.09	9.7	53.8	44	76	2.08	81.4								4.09	8.5	3.54	0.57		
		123.3		82.6	107.5	69.3	45.4	36.4	61.1	-43.07											5.50			
			69.8			54	44.4	32	57.7	-2.25		55.9			46.1	31.7	23.2	35.6	20.06	8.7		5.75		
										1.7	78.5								31.89	11.2				

											101.8		83.7	87.05	67.2	49.6	40.5	56.7					54.8	
		108.4	76.8		87.73	31.3	70.1	58.1	79.2	12.01	107.3	62.1		104.37	34.4	51.8	41.7	57.9	26.57	9.6	4.84	3.42	46.8	2.32
		69.4		79.4	56.34	65.7	53.5	37.1	69.2	0	91.1		73.4	85.51	63.4	44.4	38.8	51.8	23.81	14.2	3.10	4.55	52.1	1.33
		65.9	64.3		53.73	15.2	62.7	43	79.2	17.24	68.4	60.1		70.08	35.1	48.9	42.2	60.1	43.73	7	2.94	3.59	50.4	1.31
		98.2		79	77.59	50.8	60.6	43.3	71.1	10.9	83.8		59.3	76.58	33.5	48.8	40	59.8	36.03	30.7	4.38	1.37		
			78			47.6	62	50.8	73.3	-19.98		74.6			50.1	57.1	44.2	62.1	5.84	9.9		4.93		
										-2.46									12.94	15.6				
	2	72.1	55.2		64.4	25.6	48.9	35.2	63.3	-20.9	76.4	55.1		82.82	42.5	34.9	29.6	39.6	19.75	8.4	3.96	4.05	49.4	1.46
				76.4		45.2	61.6	49.3	74.5	-15.85			59.6		32.2	50.1	44.5	58.8		20.3		1.91		
										-18.14									6.91	8.4				
CT 4	1										131.6		83.5	113.24	69.3	46.6	32.9	61.5	9.73					
		120.2	87.8		84.52	60.5	63.7	44.7	79.6	-2.75	110.1	74		99.02	62.1	40.1	25.6	51.1	32.75	26.9	3.82	2.28	72.3	1.66
		118.8		91.1	83.49	59.6	68.6	50	84	-38.29	114.4		70.8	97.45	47.1	53	40.3	61.1	16.96	15.8	3.77	3.38	67.4	1.76
		131.2	87.2		96.88	59.1	64.3	49.4	89.1	14.19		81			66.7	45.9	33.2	55	15.49	15.5	4.17	4.06	72.8	1.80
		126.4		87.8	89.85	71.6	51.3	33.7	77.4	-32.91									4.95	11.3	4.01	3.17	67.4	1.88
		99.2	90.9			68.2	58.2	46.5	79.6	12.79											3.15			
										-15.37														
	2	102.2	85.9		79.05	58.3	62.8	43.7	78.7	-9.13	108.7	75.9		96.17	57.9	49.3	35.4	58.9	22.22	11.9	4.28	4.88	47.6	2.15
				73.8		43.7	59.6	38.4	72.3	-44.36			70.1		50.8	48.6	31.7	61.8	28.44	8.8		5.37		
		100.1																		16.1	4.19			
										-25.77														
			85.1			50.5	68.6	51.5	85.7	8.48														
	3	136.3	68.3		100.92	50.3	46.4	31.8	63.3	-17.24									11	7.4	6.08	3.40		
		95.8		105.8	59.76	85.3	62.7	48.1	80.8	-25.24											4.28			
			81.7			8.5	81.1	71.8	98	-19.2														
										-37.35									4.94	12				
	4	52.6		73.8	44.38	47.4	57.1	48.6	87.7	-61.53	49.9		81.1	37.92	45.9	67.1	58.4	83	-8.13	14	2.48	3.33	37.9	1.39
			60.5			5.1	60.5	48.1	90.6	-47.12		63.4			3.9	63.5	56.9	80.9	-4.12	10.4		0.43		
										-56.59									-33.21	8.8				

INF 6	1		92.2			63.3	67.4	62.8	100.1	-24.89														
		140.5								-2.28											3.94			
											126.8	88.4		72.49	26.2	84	69.4	100.8	23.6					
		164.8		131.6	82.27	77.9	106	85	136.1	-22.22			121.6		99.6	69.6	52.7	78.2	7.87	12.2	4.62	7.27		
			118.8			85.3	82.1	64.7	106.3	-5.24									12.58	52.6		0.81		
										-3.72														
	2	176.6	97.3		114.89	84.2	48.8	28.6	64.5	29.54	181.8	106.8		110.88	83.3	66.7	45.7	89.9	19.23	40.4	6.22	2.07	116.5	1.52
		185.3		111.8	116.35	91.9	63.8	45.9	78.9	7.25	173.7		114.2	118.75	98.2	57.4	33.4	79.4	6.47	29	6.52	3.28	141.9	1.31
		217.3	105.9		131.18	92.8	50.8	33.5	68.1	2.6	194.1	87.4		141.78	75.2	45	26.7	63.5	7.61	33.4	7.65	2.51	106.5	2.04
				132.4		124.3	45.4	33	62.5	-1.05			117.8		116.7	15.2	5.4	24.7	11.07	18.8		6.41		
										17.58									42.11	20.7				
	3	201.5	110.7		108.72	88.2	65.9	43	88.1	0	208	109.2		115.5	91.6	58.8	45.2	77.2	17.7	4.2	5.89	21.40	115.7	1.74
		194.2		137.1	104.92	112.8	77.2	52.8	100.4	5.27	214.6		135.9	117.68	115.7	71.5	56.9	86	13.12	3.9	5.68	29.29	114.5	1.70
		192.1	106.6		105.89	81.3	69.6	40.6	88.6	21.35	192.6	114.2		119.18	98.7	58.1	48.4	62.5	51.17	4.2	5.62	21.43	99.7	1.93
				133.3		110.7	73.7	54.9	92.5				108.9		93.8	55.2	42.5	57.6		23.1		4.43		
																			22.43	10.1				
	4	173.1	100.1		118.63	86.9	49.8	31.5	67.1	9.94											4.48			
		163.9		101	112.78	86	52.7	36.6	69.3	0											4.25			
			95.7			77.7	55.7	44.2	72.3	10.42		76.4			67.7	35.2	24.9	45.2	36.1	11.1		6.55	81.6	
										-4.76									55.54	12.1				
	5	304.9								5.51	304.7								8.05	20.7	10.93			
		299.6	169.4		118.22	137	99.6	92.8	126.2	5.62	309.3	174.5		129.26	156.5	77	66.5	84.8	21.12	23.6	10.74	6.22	152.1	1.97
				180.1		162.1	78.1	68.7	106	-9.61			167.7		152.7	69.8	57.2	85.3		15.9		9.90		
										13.57									27.9	10.9				
	6	172.5								1.04											5.93			
			104			76.4	70.6	53	101.3	2.07		82.9			71.3	42.2	31.2	57.1		17.4		4.24		
										-32									11.09	16.9				
	7	182.4								20.49	182.5								26.05	19.4	5.06			
										-27.11									0	5				

LI 20			122.8			79	94	67.1	113.8	0		105.9			88.9	53.1	42.2	69.8	48.72					
										-8.97									36.57					
SV 13-28	2			134.9		116.8	66.5	51.3	86.4	-6.97			118.1		107.9	47.9	35.9	54.9	11.31	13		8.64		
		204								30.42	202.2								43.19	4.1	10.36			
										6.65									32.47	1.9				
	3	195.4		123	112.7	102.8	67.4	60.6	73	19.15	227.4		142	121.22	130	59.3	51	79.4	29.92	12.3		9.46	117.6	1.66
			112			92.4	63.7	56.2	71.5			118			97.4	66.7	55.7	73.3	41.16	14.9		6.37		
										0										19.9				
	4			144.4		123.7	74.5	64.3	90.8	2.07			132.3		121.9	52.2	44.4	58.7	13.06	4.3		28.56		
										6.34									15.61	6.1				
UP 13		154.9	93.4		88.57	53.8	76.4	55.2	105.3	14.41	160.3	95.6		101.2	68.4	66.5	51.8	75.9	3.67	8.7	4.93	7.02	100.4	1.54
		163.3		125.6	97.03	100.8	74.8	52	106	-9.16	159.8		111.5	107.54	91.8	63.3	48.9	73.2	9.81	18.8	5.20	5.12	89.9	1.82
			90.4			62.1	65.9	51.8	94.1	-2.05		85.9			67.7	52.7	42.8	62.7	-2.14	13.1		4.95		
										-4.05									19.65	15.5				
UP 14	1	98.1		77.9	83.55	56	54.2	46.5	65.5	-2.01			72.9		58.8	42.7	37.5	50.5	8.8	10.8	4.88	5.31		
			69.1			42.1	54.7	49.2	68.2	-2.51									33.69	13.5		1.56		
										-16.23														
MBG 12466		132.7								1.72	144.2								39.74	12.9	3.95			
										-15.49									10.24	1.4				
MBS 258/259	1										194.2	219.8		58.87	179.8	126.3	107.2	129.9						
		175		143.8	70.72	61	129.7	118.2	162.2	2.7	141.6		161.9	50.76	11.7	161.5	141.2	172.2	39	81.4	4.94	0.45	134.1	1.30
		248.7	158.1		101.55	173.2	111.4	103	150.4	31.61	247.8	167.7		104.83	121.9	114.8	98.6	130.4	15.3	32.3	7.03	4.57	166.5	1.49
				162.7		135.5	91.1	70.1	124.5	-15.12			144.6		122.4	76.5	49.6	97.5	23.86	42.2		3.06		
										-1.79									7.95	29.1				
MBS 278		227.6								-10.68											5.06			
			125.1		64.68	10.5	125	104.6	161.9	17.65														
		223		245.5		212.3	124	104.6	156.1	15.17			239.5		226.6	77.7	63.7	92.8	30.7	57.7	4.96	3.80	102.1	2.18
										-5.62									22.95	43.5				
										2.9														

MBS 326	4										123.9								7.06					
		135.1								32.79	127.6								16.71	39.9	2.84			
										23.71									16.8	20.8				
NS 43-111		275.4								6.62	269.9								50.12	5.4	4.24			
		248.7		175.4	92.88	116.2	131.4	91.1	169		239.1		161.8	106.69	131.1	95.2	67.1	129	51.95	0	3.83		142.9	1.74
			168.1			130.7	104.3	68.7	153.8	-17.62		136.2			107.7	83	50.8	94.8	6.47	14.9		8.00		
																			74.19	8.5				
UR 8	1	314	190.2		120.74	171.7	80.6	65	104	12.07	288.1	177.2		128.8	156.5	82.3	55.5	93.1	49.13	42.9	4.85	3.83	209	1.50
				170.3		141.2	95.5	89.7	128.7	-9.73			141.5		130	56.9	43	71.5	24.61	27.7		4.90		
										-20.57									16.9	16.5				
	2	325.8		205.5	118.03	180.5	97.2	78.2	136.4	-6.28	316.8		189.7	123.86	165.3	94.2	77.5	111.8	8.75	34.9	8.27	4.95	196.4	1.66
			174.8			145.3	96.5	90.4	136.9	-11.25		170.2			151.4	75.7	61.5	93.5	32.06	19.6		7.57		
										-5.87									17.26	25.7				
UR 55		193.7	139.7		88.72	88.4	107.7	77.9	137.5	-26.23	235.5	113.2		117.38	89.6	68.7	51.8	86.4	26.97	8.1		10.99	99.1	1.95
		189.7		137.6	95.84	104.1	89.1	71.5	125.3	19.18			160.9		145.5	67.4	50.5	81.6	32.06	6.9		18.09		
			117			84.8	80.3	52.8	109.7	7.59										34.4		1.23		
										22.45														
BOS1 3		146								38.14									41.95	39.6				
			131			15.7	129.5	112.5	160.5	25.55														
										14.72									7.99	19				
TRE 5													169.4		158.2	61.6	36.9	81.6	40.26	9.7		8.15		
										-14.61									28.65					
LU1 1	1	233.7	149.4		108.74	121.6	88.1	60.8	112.1	33.28	223.9	128.4		105.44	99.2	82.6	65	104.3	72.86	26.9	5.54	4.10	135.6	1.72
				138.7		111.9	79.2	50.5	106.3				152.8		124.5	86.7	74.7	110.1	43.75	4.6		25.70		
										35.87									25.35	17.1				
	2		133.2			113.5	69.8	60.3	103.6	-7.47		121.5			105.5	61	49.1	79.2	48.93	30.8		3.56		
										15.52									37.78	22.9				
LUdt 8				153.4		86.4	126.3	94.1	160.5	13.72														
										13.65									48.33	12.5				

av		**165.6**	**105.7**	**127.2**	**92.39**	**83.4**	**75**	**58.3**	**98.2**	**-2.23**	**167.2**	**106.3**	**123.1**	**100.08**	**91.5**	**63.4**	**49.5**	**76.2**	**23.25**	**18.1**	**5.13**	**6.60**	**101.4**	**1.71**
min		**52.6**	**54.8**	**73.8**	**44.38**	**5.1**	**44.4**	**28.6**	**57.7**	**-61.53**	**49.9**	**55.1**	**59.3**	**37.92**	**3.9**	**15.2**	**5.4**	**24.7**	**-33.21**	**0**	**2.48**	**0.43**	**37.9**	**1.30**
max		**325.8**	**190.2**	**245.5**	**131.18**	**212.3**	**131.4**	**118.2**	**169**	**38.14**	**316.8**	**219.8**	**239.5**	**141.78**	**226.6**	**161.5**	**141.2**	**172.2**	**74.19**	**81.4**	**10.39**	**29.29**	**209**	**2.32**

Erpetopus Moodie, 1929

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 2	2 pI	16.9	16.2	1.04	70.71	7.8	9.2	2.17	6.2	9.2	10.2	10.9	4.9	2.1	2.5	2.4	2.8	2.8	36.4	5.98	28.68	57.42	34.66	128.48
	2 pIV	14.5	15.2	0.95	56.31	6.7	6	2.16	3.2	4.2	5.6	8.6	6.1	1.4	1.8	2.1	2.7	3.5	57.89	36.87	18.06	61.89	54.93	174.71
	2 pV	18.3	14.5	1.26	44.35	7.1	7.8	2.58	7.3	7.8	8.1	11.3		2.4	1.6	1.8	1.9		25.85	24.44	14.04		38.48	
	2 pVI	13.4	14.1	0.95	60.68	5.3	7.4	2.53	3.5	3.5	5	8.9	4.6	2.1	1.8	2.1	2.9	3.2	21.6	33.18	13.5	44.38	46.68	112.66
MSNM 27	1 pIV	16.4	18.8	0.87	68.75				5.4	4.6	7.8	8.2		1.6	1.5				31.13	51.06	40.26		91.32	
	2 pI	18.2	19.6	0.93	64.17	6.4	8.8	2.84	4.9	7.8	9.6	10.5	6.1	1.4	2.5	1.9	2		7.37	37.22	-5.33	62.69	31.89	101.95
NS 43-5	pI	15.7	16	0.98	92.12					7.7	11.3	16.6								11.86	18.45	22.34	30.31	
	pII	29.3	18.6	1.58		14	11.2	2.09	3.9	7.9	9.3	16.5		1.7	2.9				15.39	7.37	20.41		27.78	
	pIII	23.1	19.1	1.21	74.93	8.2	9.3	2.82	8.2	9.7	13.2	15.4		2.6	2.2	1.8	1.4		21.12	18.8	3.89	34.34	22.69	78.15
SV 13-28b	1 pIV	13	15.1	0.86	59.28	5.2	8.6	2.50	3.7	5.6	5.8	7.9	4.2	1.2	2.3	1.7	2.7	3.1	31.87	22.53	21.8	44.99	44.33	121.19
	1 pVI	13.1	15.4	0.85	58.04	4.6	8.3	2.85	3.9	4.9		8.6	4.7	1	2.4		2.1	2.5	48.01	35.32	33.04	26.14	68.36	142.51
	2 pI	11.1	11.7	0.95		3.5	4.5	3.17	3.4	5.3	7.8	7.8	3.9	1	1.3	1.2	1	1	34.44	14.54	21.7	40.66	36.24	111.34
V 2856	1 pII	14.8	14	1.06	62.65	6.1	9.1	2.43	3	4.1	5.7	5.5	3.5	2.1	2.5	2.5	1.4	2.9	42.67	24.2	10.68	60.71	34.88	138.26
	1 pIII	11.9	14.2	0.84	63.26	5	6.2	2.38	4.1	3	6.9	8.3	3.6	2.5	2	2.1	1.8	1.9	66.16	29.38	41.54	22.04	70.92	159.12
	1 pIV	12.9	12.9	1.00	63.83	8.6	6.9	1.50	2.3	4.9	4.9	6.5	2.9	1.4	1.8	2.1	4.3	2.1	13.43	24.59	31.98	101.94	56.57	171.94
	2 pI	13.7	12.4	1.10	45.48	7.4	8.2	1.85	3.1	3.5	4.3	4.8		2.9	1.2	0.9	2		65.62	21.77	0		21.77	

	2 pII	12.5	17.4	0.72	75.67	6.5	9.7	1.92	2.6	4.4	5.6	5.1	3	1.7	2.3	2.6	1.6	1.2	34.08	20.96	60.35	15.49	81.31	130.88
	2 pIII	19.9	18	1.11			11.7		4.1	3.9	3.8	5.7	3.7	2.3				1.2	8.47	30.42	75.63	28.93	106.05	143.45
	2 pIV	15.7	16.3	0.96	74.13	8.5	9.5	1.85	5.1	5.5	5.4		4.2	2.6	2	1.9		3.9	6.56	19.1	46.98	11.76	66.08	84.4
	2 pV	12.8	17.9	0.72		10.8		1.19	3.9	3.3	2.4	4.8	4.2	2.4					31.96	19.11	86.66	22.95	105.77	160.68
	p	10.3	14.1	0.73	40.11	5.2	6.9	1.98	1.7	3.6	4.1	4.1	3.2	1.8	2.4	1.4	1.5	1.2	78.93	22.94	23.55	49.53	46.49	174.95
V 7006	pII	6.8	6.3	1.08	55.79	3.1	3.3	2.19	2.3	2.3	2.5	4.4	1.2	0.7	1	0.8	1.4	0.8	41.29	39.75	13.37	32.47	53.12	126.88
V 7012	pII	7.9	10.1	0.78	84.98	2.5	4.1	3.16	2.6	2.4	3.1	5.7	2	1.2	1.6	1.4	1.4	0.7	78.11	10.9	41.5	52.96	52.4	183.47
	pIII	8.6	10.5	0.82	75.86	2.5	4.6	3.44	2.9	2.3	4.1	6.7	3.4	0.9	1.2	1.2	1.4	1.2	50.27	29.8	10.29	79.77	40.09	170.13
V 7039	1 pI	9.6	12.7	0.76	66.64	4.5	7	2.13	2.5	2.6	3.4	4.7	3.5	2.2	2.3	1.8	1.7	1.2	41.95	45.72	5	61.52	50.72	154.19
	1 pII	9.1	7.5	1.21			4.6		3.2	4.3	3.1	3.2		1.5	1.1				42.69	43.88	0		43.88	
	1 pIII	9.2	12.1	0.76	72.98	4.4	9.1	2.09	2.3	2.2	3.6	5	1.9	0.8	1	1.4	1.6	1.3	51.31	0	32.67	18.02	32.67	102
	2 pIII	12.9	11.4	1.13	54.04	6.7	8	1.93	3.4	4.9	5.4	6.6	2.6	1.6	2.2	1.7	1.9	1	32.78	35.54	20.34	12.19	55.88	100.85
	2 pIV	8.6	12	0.72	80.92		7.5		2.8	4.2	4.9	6.6	2.9	1.2	1.8	1.9	1.5	0.7	30.6	36.16	28.89	21.4	65.05	117.05
	2 pV	14.6	11	1.33		4.4		3.32	1.7	4.2	4.9			1	1.4	1.3			15.04	20.64	17.27		37.91	
	p	11.6	12.7	0.91	55.56	3.8	6.4	3.05	4.1	4.4	6.4		5.5	1.4	1.3	2		1.3	48.83	33.95	10.94	30.39	44.89	124.11
V 7063	pI	4.9	5.3	0.92	71.57	2	2.3	2.45	1.7	1.5	1.5	3.2	1.9	0.5	0.5	0.7	0.9	0.8	32.47	55.94	23.35	34.71	79.29	146.47
	pII	6.5	5	1.30	78.72	3.3	2.9	1.97		1.9	2.6	3.8	2.2		1.1	1.3	0.9	1.3		10.3	21.8	38.43	32.1	
	pIV	5.5	4.8	1.15	74.05	1.7	2.8	3.24	1.4	1.2	2.6	4	1.4	0.5	0.8	1	0.9	1	61.1	54.46	17.13	37.06	71.59	169.75
	p	9.1	13	0.70	70.11	3.6	6	2.53	3.1	4.1	5.8	6.9	3.9	0.9	2.2	1.4	1.5	2.1	16.18	41.68	13.97	31.19	55.65	103.02
V 7072	pI	12.5	8.9	1.40	53.9	4.4	4.3	2.84		4.3	4.1	5.7			0.9	0.9				63.43	41.78		105.21	
	pII	13.5	10.8	1.25	67	3	5.2	4.50		3.1	4.1	9.1	4		0.8	1.2	1.6	1.4		26.94	10.58	60.35	37.52	
	pIII	12.1	10.2	1.19			5.7		3.2	2.4	3.3	4.7	2.6	1.1	0.8	1.2	1.2	0.7	11.78	13.78	20.42	14.72	34.2	60.7
V 7073	1 pII	7.4	6.3	1.17	75.92	3.4	4	2.18	2	3	4.1			1.1	0.9	0.3			11.93	13.74				117.55
	1 pIII	6.4	6.4	1.00	50.96	3.2	3.3	2.00	2	2.1	2.7	3.9	1.9	0.7	1	0.8	0.9	1	58.89	23.86	14.7	38.63	38.56	136.08
	2 pIII	4.7	6.2	0.76	59.04	1.9	3	2.47	1.6	1.5	2.2	2.8	1.6	0.5	1.1	0.9	0.8	0.7	46.85	52.25	31.99	74.08	84.24	205.17
	2 pIV	5.5	6.9	0.80	59.43	3	4.1	1.83	2	1.8	2.3	3.1		1	1	0.7	0.8		33.74	4.29	56.02		60.31	
MUSE 5721	pV	19	18.5	1.03		10.3	12.2	1.84			9.7	9.3	4.5			4.2	3.6	3.1			21.55	22.02		
	pVI	16.6	15.9	1.04	57.57	9.7	7.3	1.71	4.5	8.9	5.3	8.3		4.3	2.6	3	3		38.65	27.45	29.32		56.77	
	pVII	15.6	14.1	1.11	85.36	10	9.1	1.56	1.9	4.9	5.9	4.7	4.6	1.6	2.4	2.2	2.6	3	36.59	4.75	40.35	25.03	45.1	106.72

PDVcII 13	pI	10.6	14	0.76	93.58					5.3	5.4	4.7	2.5		1.2	1.9	2.7	1		50.56	35.19	63.7	85.75	
	pII	18.8	11.1	1.69	34.07	4.8	5.3	3.92	3	3.1	9.8	11.6	4.3	1.8	1.8	1.3	1.5	0.9	44.95	34.86	12.49	20.18	47.35	112.48
	pIV	13.2	13.9	0.95	73.8				4.3	6.5	7		5.4	1.2	1.4				13.33	16.61				147.26
PDVcII 16	pIII	10.6	19.2	0.55	68.32	5.8	7.7	1.83	2.8	4.8	5.3	6.7	5	2.7	2.7	2.5	2.7	3.1	48.39	27.17	54.71	30.75	81.88	161.02
	pIV	12.4	17	0.73	73.92	6.6	10.4	1.88	4.8	6	6	7.2	2.9	2	2.5	3	2.7	2	16.9	24.19	38.25	30.55	62.44	109.89
PF 8	1 pII	9.8	7.1	1.38	92.39	1.5	3.8	6.53		4.5	7.1	9			1	1.7	1.2			5.6	18.09		23.69	
	1 pVII	7.7	5	1.54	75.96	1.9	4.1	4.05	2.3	2.9	4.1			1.1	0.9	0.9			0	4.2	5.34		9.54	
	1 pXI	5.8	6.3	0.92	80.07	2.9	4.1	2.00	2	3.1	3.1	3.3		1	1.1	1.2	0.8		30.56	0	31.98		31.98	
	2 pII	6.3	5	1.26	47.05	3.5	3	1.80	1.9	2.4	1.9	3.2		1.1	1.4	0.8	0.6		20.94	15.06	19.8		34.86	
	2 pIV	7.3	4	1.83					2.6	3.3	2.7	3		0.7	0.7	0.5	0.7		10.19	31.14	0		31.14	
	2 pVI	7	5.4	1.30	55.95				1.7	1.9	3.2	4.5		0.5	0.5	0.8	1		35.94	33.12	14.48		47.6	
	2 pVII	5.8	4.7	1.23	72.22	1.7	3.2	3.41		2.4	2.8	4.4	0.9		0.8	0.7	0.7	0.6		29.32	21.5	22.56	50.82	
	3 pI	7.5	6.5	1.15	48.01	3.4	3	2.21	2.9	2.7	3	3.5	2.7	0.7	1	0.9	0.8	2.3	15.77	12.04	24.02	85.24	36.06	137.07
	3 pI	8.3	8.8	0.94	73.3	2.4	4.7	3.46	2.5	3.6	4.9	6.1	2.5	1	1.2			1.2	33.53	0	3.75	68.78	3.75	106.06
MBG 8848	pIII	7.5	13	0.58	80.88	3.1		2.42	2.1	3.3	4.2	7.1		2	1.8	1.7			31.54	24.35	44.66		69.01	
	pIV	11	13.8	0.80	62.06	5.2	7.8	2.12	5.1	4	5	6.7	2	2	1.6	2	2.8	1.2	55.28	21.14	3.54	38.46	24.68	118.42
	pV	13.8	13	1.06	59.77	5.2	7.1	2.65	2.7	6.1	6.4		5.1	1.7	1.1	0.9		2.4	39.68	22.95	28.59	40.32	51.54	131.54
	pVI	10.6	14	0.76	92.9	5.7	8.7	1.86	4.7	5	4.2	5.3	2	1.6	1.5	1.2	1.3	1.5	0	27.21	54.02	24.46	81.23	105.69
MBG 10117	pII	10.2	12.2	0.84	45.73				4.7	5.5	6.5	6.7	2.7	1.2	1.3			1	-3	18.42	34.99	41.09	53.41	91.5
	pVI	11.7	10.9	1.07	76.85	4.9	6.2	2.39	2	4	5.8	6.4	4.6	1.1	0.9	0.8	1.2	1.9	41.92	13.51	10.47	38.5	23.98	104.4
MBG 12465	1 pV	7.3	7.6	0.96	66.8	2.4	3	3.04	2.4	2.8	3.6	5.3	3.8	1	1	1	1.2	1	38.05	50.91	35.93	62.5	86.84	187.39
	1 pIX	8.6	9.5	0.91	79.41	3		2.87	2.4	2.5	2.9	3.8	3.1	1	0.9	1	0.8	0.9	46.42	12.62	47.12	71.66	59.74	177.82
	1 pXI	9.1	8	1.14	59.14	2.9	4.4	3.14	1.9	3.1	3.9		2	1.1	1.4	0.8	1.4	1	71.91	13.33	26.17	67.17	39.5	178.58
	3 pI	8.7	13.8	0.63	108.92	4.9	6.8	1.78	2.7	3.4		4.7	4.4	0.8	1.1		1.3	1.5	35.31	24.07	28.79	68.78	52.86	156.95
	3 pIII	8.5	13.4	0.63	76.81		8.1		2.4	3.2	3.6	4.8	2.7	0.7	1	1.2	2.1	2	5.45	43.21	13.24	76.7	56.45	138.6
	3 pVIII	9.5	13.7	0.69	85.32	4.4	7.3	2.16	4.3	4.3	4.4	4.3	4.2	1.5	2.4	1.7	1.3	1.7	60.15	12.76	46.79	64.09	59.55	183.79
	3 pXII	8.5	15.7	0.54	77.8	3.7	5.8	2.30	4.2	4.1	3.9	5.5	4	0.8	1.2	1.5	0.8	1.3	14.39	85.84	55.77	15.97	141.61	171.97
	3 pXIII	8.3	15.1	0.55	91.22	5.2	8	1.60	4	3.8	2.5	4.8	2.4	0.9	1.1	1	1.2	1	19.93	48.65	47.2	39.29	95.85	155.07
	3 pXIV	8.9	15.9	0.56	86.26	5.2	8	1.71	3.3	4.1	4.1	4.9	3.2	0.8	1	1.2	0.8	0.7	29.29	37.67	63.9	37.47	101.57	168.33

	4 pIV	7.8	8.7	0.90		3.4	4.2	2.29	3.4	2.7			3.5	0.8	0.8	1		1	24.9	30.26	15.6	72.47	45.86	143.23
	4 pV	8.9	8.7	1.02	47.49		5.1		2.2	3.3	3.6		1.7	1	0.9	0.8	0.9	1.1	79.38	22.73	15.26	84.97	37.99	202.34
	5 pIII	8.3	9.5	0.87	64.02	3.4	5.1	2.44	3.1	3.3	4.1	4.3	2.6	0.9	1.1	1.2	1.2	1.4	34.51	13.8	17.5	32.02	31.3	97.83
	5 pIV	10.2	8.1	1.26	42.31	4.4	4.7	2.32	2.4	2.8	3.7	5.1	1.6	1.1	0.8	1	1.2	0.8	46.41	20.87	19.76	34.52	40.63	121.56
MBG 12480	pII	12.9	12.6	1.02	63.77	5.3	5.2	2.43	2.9	2.2	4	7.7	3.7	0.8	1	0.9	1.3	1.5	23.01	26.45	16.17	46.56	42.62	112.19
	pIII	13.7	12.4	1.10	80.1	5.3	4.8	2.58	3.1	4.4	4.7	6.5	2.2	0.9	0.9	1	0.8	1.3	32.77	4.34	21.55	55.35	25.89	114.01
	pV	11.8	13.3	0.89	75.28	5.7	6.7	2.07	3	3.4	5.6	5.5	4.7	0.8	1.1	1.2	1	3	19	18.58	28.18	61.34	46.76	127.1
	pVI	12.2	11.1	1.10						2.7	4.2		2.3			1.2		1		52.99	15.68	41.9	68.67	
	pVIII	12.4	14.9	0.83					2	2.1	2.7	4.2	4	0.8	0.8	1	0.8	0.8	11.24	15.91	21.08	58.81	36.99	107.04
	pIX	11.9	14.1	0.84	84.14	4.1	6.6	2.90	2	3.8	3.4	8.8	4.5	1.2	1.2	0.9		1.8	61.85	-3.18	29.7	51.33	26.52	139.7
MBG 12520	pI	8.6	9.3	0.92	67.57	4	6.5	2.15	2.7	3.6	4.7	5.8		1.9	2.2	1.9			26.64	35.81	9.97		45.78	
	pIII	10.8	12.6	0.86	82.36	5.7	8.4	1.89	2.6	3.5	4.6	5.5	1.8	2	1.3	1.5	1.7	1.1	17.8	26.15	29.41	18.37	55.56	91.73
	pVI	12.4	14.1	0.88	84.4	6.2	8.5	2.00	3.8	6	6	6.3		2.3	1.8	2.4	2		54.51	0	45.19		45.19	
	pVII	8.7	11	0.79	90.11	5	6.8	1.74	2	3.3	3.6	5.6	1.8	1.3	2.1	1.6		1.1	16.21	12.96	42.98	42.42	55.94	114.57
	pVIII	11.3	13.4	0.84	72.33	5.9		1.92	2.7	4.1	6	5.6		1.5	2	2.3	1.6		-15.69	23.45	42.98		66.43	
	pX	11.2	14	0.80	75.22	5.8	6.9	1.93	4.2	4.9	5.7	5.5		2.2	2.8	3	2.3		8.2	27.21	30.04		57.25	
	pXI	9.8	12.5	0.78		5.7	5.7	1.72		4.1	3.5		2.3		1.5	1.9			11.15	-4.41	40.96	39.62	36.55	87.32
	pXIII	9.6	13.1	0.73	106.15	5.7	7.8	1.68	3.2	3.5	4.1	4.7	2.3	1.7	1.3	1.9	1.6	1.2	21.85	5.63	58.86	42.91	64.49	129.25
MBS 319	pI	10.2	11	0.93	55	4.2	5.8	2.43	2.3	2	1.6	5.2	3	0.8	1	1	1.7	1.5	32.22	32.65	46.76	50.5	79.41	162.13
	pII	10.3	12.5	0.82	78.04	5.6	5.5	1.84	2.8	3.9	5.2	6	4.4	1.7	1.9	2	1.4	1.8	25.34	20.82	46.32	53.88	67.14	146.36
	pIII	9.5	14	0.68	68.25	4.9	7.3	1.94	2.7	4.6	2.1	4.7	3	1.3	1.3	1.3	1.3	1.3	50	17.83	49.52	38.18	67.35	155.53
	pIV	10	14.9	0.67	74.14	5.3	6.3	1.89	3.2	4.4	5.3	7	4.1	1.7	1.9	1.6	1.7	1.8	27.5	19.61	42.56	43.26	62.17	132.93
	pV	11.7	11.4	1.03	54.29	5.2	5.8	2.25	1.8	3	4	5.5	2.5	1.5	1.3	1.5	1.4	0.9	27	15.24	44.66	43.06	59.9	129.96
	pVI	11	12.8	0.86	64.12	5.4	6.5	2.04	3.3	4.2	5.9	6.8	3.5	2.1	1.7	1.6	1.8	1.8	20.24	27.05	29.58	48.96	56.63	125.83
	pVII	11.2	12.9	0.87	60.67	6	6.3	1.87	3.8	3.6	5.8	6.3	3.6	1.9	2	2	2	1.6	41.4	17.39	44.38	67.48	61.77	170.65
NS 43-311	pI	10	10.2	0.98	67.67	5.8	5.6	1.72	1.6		3.2	5	2.8	1.5		3.1	4.8	2.7			30.7	61.89		192
	pIV	7.6	13	0.58	65.73	3.6	6.7	2.11	3.2	3.8	4.4		3.3	1.7	2.5	2.5		1.8	56.02	30.22				157.25
	pV	10.5	11.2	0.94		5.1	6.2	2.06	2	1.9	3	3.1	3.2	1.6					6.86	41.63	23.85	59.92	65.48	132.26
MUSE 7086	2 pII	10.9	20.5	0.53	76.55	4.6	11	2.37	4.6	4	4.3	5.9	5.7	2.4	1.4	1.4	1.8	2.4	63.27	7.38	27.03	39.04	34.41	136.72

	2 pIV	10	10.5	0.95	93.98	4.1	6.4	2.44	3	3	3.3	5.9	2.9	0.5	0.9	0.8	1.5	1.1	43.68	6.3	29.61	71.33	35.91	150.92
	2 pVI	10.3	11.9	0.87	96.58	5.6	8	1.84		3.4	3.8	6	4		1.2	1.4	1.7	2.1		16.56	18.42	42.25	34.98	
	2 pIX	10	18.4	0.54	59.83	6.6	8.6	1.52	4.9	5.1	2.7	3.6	2.4	1.2	1.7	1.7	2.4	1.5	20.67	26.77	24.45	45.82	51.22	117.71
	2 pXI	12.7	18.2	0.70	88.43	6.6	11.3	1.92	5.8	6.3	6.5	6.8	5.1	1.7	1.7	2	1.8	2.6	15.91	21.18	25.67	27.61	46.85	90.37
	2 pXIII	11.7	16.3	0.72	86.77	6.6	11.2	1.77	3.6	2.8	4.4	7.2	2.5	1.1	1.2	1.5	1.6	1.4	10.57	39.25	23.66	83.93	62.91	157.41
	3 pI	11.8	16.7	0.71	64.36				3.3	4.3	4.1	4.4	4.6	0.9	0.8	1.6	1.5	1.8	33.91	10.68	14.48	86.32	25.16	145.39
	3 pII	11.6	14.8	0.78	91.72				4.9	6.8	8.5	12.1	1.9	0.2	1.3		1.2	1.2	8.33	19.93	12.79	40.63	32.72	81.68
	3 pV	8.1	10.2	0.79	68.31					2.5	3.8	4.1	2.2		1.3	1.6	1.6	1.5		12.37	5.18	54.54	17.55	
	3 pVII	7.7	13.1	0.59	71.08	4.7	7.8	1.64	3.7	2.9	2.9	3.3	3.4		0.9	1.2	1.3	1.7	24.54	20.93	11.96	49.03	32.89	106.46
av		**11.1**	**12.3**	**0.94**	**70.25**	**5**	**6.6**	**2.34**	**3.2**	**4**	**4.8**	**6.2**	**3.3**	**1.4**	**1.5**	**1.5**	**1.6**	**1.6**	**31.98**	**24.32**	**27.54**	**45.97**	**52**	**134.72**
min		**4.7**	**4**	**0.53**	**34.07**	**1.5**	**2.3**	**1.19**	**1.4**	**1.2**	**1.5**	**2.8**	**0.9**	**0.2**	**0.5**	**0.3**	**0.6**	**0.6**	**-15.69**	**-4.41**	**-5.33**	**11.76**	**3.75**	**60.7**
max		**29.3**	**20.5**	**1.83**	**108.92**	**14**	**12.2**	**6.53**	**8.2**	**9.7**	**13.2**	**16.6**	**6.1**	**4.3**	**2.9**	**4.2**	**4.8**	**3.9**	**79.38**	**85.84**	**86.66**	**101.94**	**141.61**	**205.17**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 2	2 mI	13.1	13.4	0.98	58.88	6.7	7.1	1.96	3.8	5.3	6.3	7.6	4.1	2.1	2.5	2.5		3	34.38	28.77	27.12	82.98	55.89	173.25
	2 mII	13.8	16.6	0.83	59.04	6	9.9	2.30	3		6.7	8.1	4.9	1.3		1.4	1.8	3.3			4.4	53.69		101.25
	2 mV	13.1	13.8	0.95	85.6	5.3	6.7	2.47	4.4	6.7	6.7	7	3.9	2.2	1.9	1.8	1.9	3.2	37.68	29.37	15.71	72.18	45.08	154.94
	2 mVI	12.7	13.1	0.97	50.97	5.6	6.7	2.27	3.2	5	5.7	7.1	3.9	1.4	2	1.8	2.1	2.6	57.36	34.68	9.19	72.03	43.87	173.26
MSNM 27	1 mII	11.6	11.3	1.03	55.66					5.8	7.3	7.7			1.7	1.5	1.2		36.2	30.17	-6.33		23.84	
	1 mIII	13.5	15.3	0.88						7.5	10.3	11.6	4.5		1.1	1.3	1.8	1		14.62	22.07	9.74	36.69	
	1 mIV	14.6	14.1	1.04	64.54	4.6	7.9	3.17	3.3	5.1	7.3	8.4	3.9	1	1.8	1.5	1.6	1.3	49.92	18.84	7.94	46.83	26.78	123.53
	2 mI	11.3	15.4	0.73	85.96	4.2	8.8	2.69	3.4	5.6	7	7.5		2	2.2	2.3	2.4		8.29	8.44	14.32	69.57	22.76	100.62
NS 43-5	mI	13	17.6	0.74	59.97	6.1	11.9	2.13	5.2	8.6			3.1	2.3	2.6	2.2			15.28	9.58				65.83
SV 13-28b	1 mII	9.4	12.8	0.73	63.46	3.5	5.9	2.69	3.8	3	4.2	5.9	3.2	1.3	1.8	1		1.4	69.17	36.51	-7.23	93.85	29.28	192.3

	1 mIII	9.6	11	0.87	71.28	3.6	6.8	2.67	2.2	3	4.8	7		1.3	2	2	2.2		65.89	23.02	31.13		54.15	
	1 mIV	9.8	10.8	0.91	100.2	4.5	5.2	2.18	2.1	3.3	5.8	7.5	4	1.2	1.2	1.4	2	2.2	20.14	22.91	34.77	52.03	57.68	129.85
	1 mV	10.8	14.5	0.74	71.77	5.2	8.4	2.08	2.8	3.1	4.6	5.1	3.8	1.4	0.8	1.5	1.5	1.6	33.99	46.43	41.61	22.67	88.04	144.7
	2 mI	7.4	8.7	0.85	60.1	3.4	3.8	2.18	2.3	3.5	4.4	4.2	2.4	1	1.6	1.1	1.3	1.1	51.75	25.29	19.68	71.31	44.97	168.03
	2 mIII	8	8.5	0.94	59.43	2.6	5.6	3.08	2	3.8	5.1	5.5	2.8	1.2	1.1	0.8	0.9	0.7	22.11	19.63	18.14	50.59	37.77	110.47
	2 mV	7.9	9.1	0.87		3.5	3.6	2.26		2.1	3.8	4.8	3.1		1.4	1.6	1.4	1.3		40.1	34.65	34.29	74.75	
	2 mVII	8.2	8.2	1.00	81.84	4.1	4.6	2.00	2	3.1	4.4	4.4	2	1.5	1.2	1.4	1.3	1.3	23.02	47.58	25.63	65.08	73.21	161.31
V 2856	1 mI	10.2	11.1	0.92		5.8		1.76		2.8	3.8	5.8	4.5		2	2.1	2	2.6		25.08	40.69	59.78	65.77	
	1 mII	10.1	11.8	0.86	64.98	4.2	7.2	2.40	3	4	5.4	6.2	2.6	1.8	1.3	0.9	1.9	2.2	32.81	35.91	18.18	58.52	54.09	145.42
	1 mIII	9.8	11.7	0.84	58.33	5.6	8.2	1.75	2.8	3	4.1	6.2	2.4	1.4	2.2	2.5	2.4	2.3	19.93	43.07	39.89	31.17	82.96	134.06
	1 mIV	11.3	11.5	0.98	68.45	4.9	5.2	2.31	2.6	3.2	5.5	7.1	3.3	1.2	1.3	1.7	2.4	2	54.73	24.93	4.58	76.13	29.51	160.37
	1 mV	9.6	12.6	0.76	60.69	4.7	6.5	2.04	2.8	2.9	4.1	6.5	4.1	1.7	2.5	2.1	2	2.3	54.7	36.36	39.04	45.46	75.4	175.56
	1 mVI	11	12.2	0.90	71.12	5.8	6.9	1.90	2.6			5.9	3.8	2.7			1.9	2.6	16.57	10.54	39.27	84.23	49.81	150.61
	2 mI	10.2	13.9	0.73	59.53		7.1		4.1	2.1	3.9	3.4	3.4	1.3	1.1	2.1	1.7	2.5	89.49	21.62	23.54	54.97	45.16	189.62
	2 mII	10.3	12	0.86	102.16	4.5	6.5	2.29	3.3	4.2	5	4.9	2.8	1.7	1.6	1.6	2	1.1	17.22	5.83	48.88	73.96	54.71	145.89
	2 mIII	11.5	14.9	0.77	54.17	5.5	6.1	2.09	4.7	4	4.4	6.2	4.4	2	1.5	2.3	2.6	1.5	34.89	54.81	28.26	27.84	83.07	145.8
	2 mIV	10.6	9.9	1.07	71.85	6	6.3	1.77	2.1	3.1	4.7	5.6	2	1.9	1.6	2.4	1.6	1.1	0	30.1	22.43	63.4	52.53	115.93
	2 mV	10.5	11.8	0.89	55.5		7.3		2.6	2.8	3.5	4.2	2	1	1.4	1.9	2.2		40.82	58.62	24.18	32.61	82.8	156.23
	2 mVI	10.7	12.5	0.86	92.66	5.8	8.2	1.84	2.3	4	3.9	4.4	2.7	2.3	1.8	2.4	1.4	2.5	16.1	25.84	35.07	65.31	60.91	142.32
V 7006	mI	4.1	5.4	0.76	80.51	2.5	2.8	1.64	1.7	1.6	1.8	2.8	1.1	1	1.3	0.9	1.1	0.6	67.81	39.95	33.94	51.75	73.89	193.45
	mII	5.2	5.8	0.90	77.69	2	3.9	2.60	1	1.6	2.6	3.5	1.1	1	1.2	1.3	1.1	1.1	20.17	35.42	22.57	56.73	57.99	134.89
	mIII	4.4	5.1	0.86						1.2	1.5	2.2	1.1		0.7	0.5	0.8	0.7		34.88	30.96	100.06	65.84	
	mIV	6.2	5.2	1.19	79.49	3.3	4.4	1.88		1.6	2.5	3.6	1.4		1.2	1.5	0.9	0.8		19.32	24.08	20.26	43.4	
	mV	5.8	6.3	0.92	74.2	2.8	4.1	2.07	1.4	1.7	2.1	3.6	1.6	1.4	1	1.1	1.1	1.3	40.66	25.97	27.72	52.83	53.69	147.18
V 7012	mI	8.7	9.4	0.93	60.07	2.7	4	3.22	1.7	2.4	3.5	5.4	2.7	1	1.2	1.1	1.8	1.7	84.78	55.81	10.42	47.61	66.23	198.62
	mIII	5.2	10.1	0.51	93.65					2.3	3	3.3	3.2		1.2	1.1	1.2	1		48.08	12.89	34.72	60.97	
V 7039	1 mI	8.4	10.5	0.80			4.6		3.6	2.5	2.5	4.8	2.5	1.3	1.6	1.4		1.9	35.22	49.16	25.87	62.87	75.03	173.12
	1 mIII	8	10.5	0.76	94.4		5.2		2.3	2.3	2.9	3.7	2.2	1	1.5	1.6	0.9	0.9	55.67	17.79	48.95	44.63	66.74	167.04
	1 mV	6.8	9.9	0.69	81.61		5.5		2.5	2.5	3.8	4.3	2	0.8	1	1.2	1	0.8	32.81	31.35	18.75	66.66	50.1	149.57

	1 mVI	6.9	9.6	0.72			6.6		1.4	2.8	3.6		2.3	0.7	1.1	1.3		1.6	12.71	22.46	19.41	100.62	41.87	155.2
	1 mVII	8.7	9.8	0.89	85.34	4.3	5.8	2.02	2.3	3.1	4.4	5	2.1	1.3	1.1	0.9	1	1	32.08	38.17	32.59	29.57	70.76	132.41
	1 mIX	8.5	10.2	0.83	77.57	4.3	6.3	1.98	2.7	2.6	4.4	4.4	2.6	1.8	1.4	1.5	1.6	1.7	45.41	22.46	18.02	44.83	40.48	130.72
	1 mXI	7.7	8.8	0.88	81.72	2.7	4.1	2.85	2.9	2.2	3.3	2.1	2.6	1.2	1.8	0.9	0.7	0.9	73.53	16.34	29.31	80.13	45.65	199.31
	2 mIII	8.6	10.9	0.79	87.62	4.6	5.6	1.87	2	2.9	4.1	5	3.4	1	1.6	1.9	2.2	2	42.28	7.68	42.19	17.04	49.87	109.19
	2 mV	10.6	10.3	1.03	72.81	4.4	7.3	2.41	2.3	3.4	5.4	6.7	1.3	0.9	1.5	1.9	2.5	1.4	40.82	23.43	9.54	18.61	32.97	92.4
	2 mVI	9.6	12.5	0.77		4.8	6.9	2.00	2.2	3.3	4.8	6	3.8	1.1	1.2	1.6	1.5	0.8	21.13	15.34	46.46	36.73	61.8	119.66
	m	9.2	13	0.71	70.58		7.8		2.7	2.7	3.9	5.3	3	1.7	0.9	1.3	1.7	1.3	38.62	33.75	31.19	39.41	64.94	142.97
	m	8.4	9	0.93	96.8	4.9	4.7	1.71	3.4	3.2	4	4.1	1.6	1	1.4	1.4	1.8	1	32.61	32.59	37.14	21.53	69.73	123.87
V 7063	mI	4.3	5.3	0.81	78.11	1.2	2.1	3.58	2	2	1.9	2.9	1.7	0.5	0.6	0.8	0.9	1.1	36.07	60.64	22.69	104.35	83.33	223.75
	mII	4.7	5.2	0.90	97.43	1.9	2.4	2.47	1.9	1.5	1.9	3.9	1.6	0.7	0.8	0.8	0.8	0.7	57.22	64.94	18.44	64.62	83.38	205.22
	mIII	4.3	5.2	0.83	80.08	2.3	2.2	1.87	1.2	1.8	2	2.9	1.3	0.6	0.8	0.8	0.7	1.4	29.6	49.4	45	88.45	94.4	212.45
	mIV	4.2	5.5	0.76	99.17	1.4	2	3.00	2.2	1.3	1.6	3.1	2	0.4	0.6	0.7	0.7	0.7	61.98	55.14	51.58	85.25	106.72	253.95
V 7072	mI	5.9	11.3	0.52	71.2	2.5	5.6	2.36	2	1.9	3	3.6	5.2	0.8	1.3	2	1.8	1.2	63.57	51.54	7.78	61.68	59.32	184.57
V 7073	1 mI	3.6	6.3	0.57	94.91	1.4	3.4	2.57	2	2.3	2.3	3	1	0.5	0.8	0.7	1.2	0.6	41.19	46.08	27.34	53.28	73.42	167.89
	1 mII	5.5	5.3	1.04	75.96	2.5	3.7	2.20		1.9	2.9	3.8	1.7		1.3	0.9	1	0.9		12.53	27.76	26.36	40.29	
	1 mIII	4	4.6	0.87	80.76	0.8	1.8	5.00	1.5	1.5	1.8	2.9	1	0.6	0.8	0.8	0.7	0.9	53.54	66.21	44.06	112.01	110.27	275.82
	1 mVI	4.6	5.8	0.79	95.92	1.9	3.3	2.42	1.6	2.3	3	3.4	1.4	0.7	0.8	0.9	1	1	40.12	29.74	35.2	57.27	64.94	162.33
	2 mIII	5.4	6.4	0.84	106.26	2.6	2.3	2.08	2.2	2.8	2.8	3.1	2.2	0.6	0.8	0.9	1.1	1.1	28.8	38.45	68.21	69.87	106.66	205.33
	2 mIV	4.3	6.7	0.64	80.75	1.4	2.5	3.07	1.4	2	2.5	3.2	2.2	0.5	0.7	1.3	1	0.9	36.34	13.58	68.22	54.58	81.8	172.72
MUSE 5721	mIII	14.6	14.9	0.98	58.74	8.5	9.1	1.72	3	5.4		6.3	4.4	3.5			1.9	3.1	39.97			40.51		136.8
	mV	13	15.9	0.82		7.1	8.8	1.83	4.4	4.8	4.4	4.6	4.7	2.6	2.3	2.2		2.7	33.32	59.74	31.41	29.52	91.15	153.99
	mVI	9.7	11.2	0.87		6.9	8.3	1.41	3.7	4.3				3.2	2.9				32.49					
	mVII	14.9	14.2	1.05	64.89	7.1	8.8	2.10	4	4.9	5.9	8.7	3.6	3.2	2.2	2		2.7	100.86	14.84	11.9	73.63	26.74	201.23
PDVcII 13	mI	14.6	9.4	1.55	82.07	4.8	4.9	3.04	2.8	6.4	6.9	6.2	3.5	1	0.9	1.1	2.3	1	23.27	23.47	35.9	85.98	59.37	168.62
	mII	10.7	11.7	0.91	61.8	2.9	4.8	3.69	3.5	3	4.7	7.5	3.4	1.2		1.4	1.2	1.1	80.42	34.28	30.7	29.88	64.98	175.28
PDVcII 16	mI	9.7	16.9	0.57	89.36	4.6	9	2.11		5	4.8	6.7	5.1			2.5	2.6	2.2		55.34	40.57	66.5	95.91	
	mII	12.1	17	0.71	78.56	4.4	7.5	2.75	4.4	5.3	4.7	4	6.7	1.5	1.4		1.7	1.8	52.19	29.78	46.36	74.94	76.14	203.27
	mIII	10.5	17.8	0.59		5.9	8.6	1.78		5.1	5.3	7.7	4.3		2.1	2.5	2.8	2.4		34.38	38.25	39.04	72.63	

	mIV	11.5	14.8	0.78	98.13	5.9	7.2	1.95		3.5	5.9	8.4	3.3			2.3	1.8	1.8		27.41	40.17	26.25	67.58	
PF 8	1 mI	6.3	5.3	1.19	58.83	2.4	3	2.63	1.7	3	3.7	4.7		1	0.7	0.9	0.7		34.52	10.44	26.97		37.41	
	1 mII	6.3	8.6	0.73	75.07	2.2	3.3	2.86	2.5	2.3	2.3	5.5	2.8	0.6	1.4	1	0.8	0.9	40.52	45.2	47.17	19.2	92.37	152.09
	1 mIII	4.1	8.7	0.47	89.95	2	3.5	2.05	3.2	2	1.8	3.4	2.2	0.9	1	0.7	0.7	0.8	43.25	25.97	73.69	39.26	99.66	182.17
	1 mVI	5.8	4.3	1.35	51.7	3	2.5	1.93		1.6	3	2.6	1.6		1	0.8	0.9	0.7		38.99	8.91	27.47	47.9	
	1 mIX	4.7	3.7	1.27	79.11	1.5	3	3.13	1.5	2.3	3.4	2.9		0.5	0.7	0.8	1.1		23.05	6.2	5.57		11.77	
	2 mVII	3.4	3.7	0.92	77.2	1.3	3	2.62	0.9	2.3		2.3	1.1	0.7	1.2		0.6	0.8	30.76			8.78		82.12
	3 mI	6.8	4	1.70	56.89	2.7	3	2.52	1.5	2.3	2.4	2.2	2.5	0.6	0.6	0.6	0.7	1	12.46	-3.37	37.87	102.95	34.5	149.91
MBG 8848	mI	8	10.3	0.78	67.83	4.1	5.5	1.95	2.5	3.1	3.8	4.6	3.1	1.2	2.1	1.4	1.5	1.6	42.16	17.77	24.87	22.53	42.64	107.33
	mIII	6.7	10.4	0.64					2.6	3.2	3.6			1.6	2	1.7			19.12	7.84	45.9		53.74	
MBG 10117	mII	7.3	9.3	0.78	77.26		3.6		2.9	2	2.1	5.2	3.1	0.9	0.6	0.7		1.8	72.85	-16.15	84.29	82.68	68.14	223.67
MBG 12465	1 mI	6.9	7.5	0.92	82.23	2.7	2.9	2.56	1.4	1.8	2.7	3.5	2.2	1	1.2	0.8	1.2	1.3	72.26	17.47	40.76	76.97	58.23	207.46
	1 mIV	6.4	6.9	0.93	86.19	1.9	3.2	3.37	2.4	1.9	3.2	4.2	2.6	1.1	1.1	1	1.5	1.1	68.54	38.05	37.69	94.83	75.74	239.11
	1 mVIII	8.6	9	0.96	78.4	3.2	5.6	2.69	2.2	2.6	4.2	5.2	2.6	1.2	1.4	1.1	1.1	1.4	71.06	22.07	12.09	75.79	34.16	181.01
	1 mIX	6.4	7.6	0.84	59.67	2.5	4.2	2.56	2.6	2.3	2.9	3.7	2.2	1.1	1.3	1	1	1.1	23.26	45	47.73	65.36	92.73	181.35
	1 mXI	8.5	8.3	1.02	80.43	2.7	3.4	3.15	2.4	1.9	1.2	4.1	3.2	1.4	1.4	1.1	1.1	1.8	51.1	37.57	32.28	96.17	69.85	217.12
	1 mXII	6.6	9.1	0.73	86.11	3.2	4.1	2.06	3.3	2.9	3.7	3.9	2.8	0.9	1.1	1.2	1.2	1	45.86	25.35	54.69	60.55	80.04	186.45
	1 mXIII	10.2	7.5	1.36	79.26	1.9	3	5.37	2.8	2	3.7	4.8	2.3	1	0.9	1.2	1.3	1.3	85.53	57.09	2	45.68	59.09	190.3
	1 mXIV	6.4	8.1	0.79	43.03	2.9	3.4	2.21	2.6	2.3	2.5	3.1	2.4	0.8	1	1	1	0.9	51.77	46.04	22.11	61.26	68.15	181.18
	3 mIX	10.8	10	1.08	92.12	4.1	4.2	2.63	4.1	3.2	2.2	1.7	4.5	1.2	2	1.4	1	1.2	52.82	22.89	80.54	85.24	103.43	241.49
	3 mX	7.3	13	0.56	73		5.6		3.2	2.4	3.7	4.6	4.1	0.8	1	1.2	1.2	0.8	55.55	30.5	12.94	77.95	43.44	176.94
	3 mXII	9.8	10.8	0.91	103.5	3.9	4.9	2.51	3.4	4.4	5.6	4.9	4.2	0.9	1.3	1.5	1.4	1.4	41.07	31.76	41.63	60.54	73.39	175
	3 mXIV	10.7	9.8	1.09	101.77	4.9	4.6	2.18	3	2.5	3.6	4.5	4.3	1.3	1.2	1	1.3	1.3	41.45	28.3	44.14	86.51	72.44	200.4
	3 mXV	7.6	11.9	0.64	90	3.6	6.4	2.11	2.2	3.4	3.4	4.3	2.8	1	1	1.4	1.4	1.4	47.35	48.81	57.17	43.66	105.98	196.99
	3 mXVI	11.3	11.7	0.97	104.04	4.7	4.9	2.40	3.4	3.1	4.6	5	3.4	1	0.9	1.4	1.7	1.1	45.4	12.15	62.3	77.46	74.45	197.31
	3 mXVII	8.1	11.9	0.68	59.89	3.4	5.9	2.38	2.3	2.7	3.2	4.3	3	1.1	1.2	1.4	1.4	1.1	21	40.91	23.84	52.34	64.75	138.09
	3 mXVIII	8	11.7	0.68	72.55	3.7	5.9	2.16	2.4	3.1	3.4	3.5	3.4	0.9	0.9	1	1	0.8	36.98	51.77	47.82	52.49	99.59	189.06
	3 mXIX	8	11.9	0.67	61.82	2.9	5.8	2.76	3.1	3.4	2.7	4.5	2.9	0.9	0.9	0.9	1.2	1	40.19	63.43	20.19	65.78	83.62	189.59
	3 mXX	9.5	9.7	0.98	100.22	5.4	5.8	1.76	3.4	2.8	4.6	4.6	2.4	1.5	1.5	1.7	1.1	1.4	32.86	32.12	31.33	39.8	63.45	136.11

	3 mXXII	8.6	11	0.78	97.37	4.1	5.8	2.10	2.1	3.6	3.6	4.2	3.3	1	0.8	1.2	0.8	1.3	38.03	22.88	63.43	54.96	86.31	179.3
	4 mIII	10.3	9.6	1.07	56.73	4.7	5.1	2.19	3	2.2			2.4	0.8	1	1	0.9	1.4	54.88	40.69	36.81	23.47	77.5	155.85
	4 mIV	8	6.8	1.18	91.74	4.1	2.9	1.95	2.3	2.3	2.2	4.6	2.1	0.8	0.9	1	1.3	1.4	49.4	26.57	36.03	51.97	62.6	163.97
	4 mVIII	6.4	8.3	0.77	65	2.9	4.6	2.21	1.7	2.3	2.9	3.4	2.1	1.1	0.8	1	1	0.8	46.17	43.73	46.17	34.68	89.9	170.75
	4 mIX	8.5	8.5	1.00	56.31	3.6	4.1	2.36	2.8	2	2.7	5.3	1.9	1	0.8	1.2	1.4	1.4	69.32	48.58	22.43	43.73	71.01	184.06
	4 mX	7.1	7.8	0.91	69.44	4.1	3.7	1.73	2.7	2.1	2.9	3.5	3	0.8	0.8	1	1	0.7	41.54	49.9	42.51	58.51	92.41	192.46
	5 mI	7.3	7.8	0.94	57.8				2.6	2.2	3.9	3		0.8	1	1.4	1.4		83.7	49.91	32.82		82.73	
	5 mIII	8.3	8.6	0.97	76.76	3.7	3.6	2.24	3.2	4.2	4.6	4.5	2.9	1	1	1.4	1.2	1.1	32.49	26.57	34.51	77.94	61.08	171.51
	5 mV	8.1	10.3	0.79	55.3		6.1		2.3	2.5	3	3.9	1.7	0.9	1	1.2	1	1.2	56.79	52.13	3.95	86.1	56.08	198.97
MBG 12480	mII	8.6	10.1	0.85	84.09	4.9	6.2	1.76	1.8		3.6	4	1.8	1	0.8			1.2			31.37	87.24		191.31
	mIV	8.6	8.9	0.97	77.43	4.1	4.7	2.10	1.6	3.9	4.7	5.4	3.1	1.3	1.3	1.5	1.8	2.4	8.25	29.47	41.46	71.24	70.93	150.42
	mV	9.3	10.6	0.88	78.98	4.7	7.6	1.98	2.5	3.5	4.7	3.6	1.4		1.4	1.4	1.8	1.1	25.14	9.78	22.14	57.57	31.92	114.63
	mVII	9.3	10.8	0.86	77.34	3.9	5.3	2.38	3.2	3.1	3.9	6	1.9	1.2	2.5	2	1.2	1	71.57	20.88	31.15	27.61	52.03	151.21
	mVIII	9.7	11.4	0.85	54.46	3.9	5.8	2.49	3.3	2.9	4.8	6.1	2.3	2.1	1.6	1.6	1.7	1	22.43	45.9	28.26	46.22	74.16	142.81
	mIX	8.9	10	0.89	59.8	2.7	3.2	3.30	4.3	3.6	3.5	5.8	3.2	1.7	1.4	1.4	1.1	1.4	40.09	66.47	22.75	88.35	89.22	217.66
MBG 12520	mI	8.3	8.6	0.97	82.51	4.1	4.9	2.02		2.1	3.8	4.6	2		1.3	1.8	1.3	1.7		34.29	19.68	40.78	53.97	
	mIII	9.6	12.2	0.79	76.32				3.5	3.9	4.5	5.2		1.6	1.2	1.4	1.7		11.61	27.24	43.85	71.81	71.09	154.51
	mV	10.9	12.6	0.87	72.82	6	6.5	1.82	3.3	3.8	4.8	5.7	2.9	2.2	1.6	2	5.7	2.9	23.37	38.75	33.33	54.87	72.08	150.32
	mVI	8.4	12.8	0.66	84.61	3.9	7.1	2.15	2.7	3.5	4.6	5.5	4.3	1.7	1.1	1.9	1.4	1.7	18.19	36.21	19.05	39.78	55.26	113.23
	mVII	6	11.8	0.51	91.51				2.5	3.7	4.7	5.3		1.5	1.3	1.1	5.1		39.93	17.05	42.34		59.39	
	mVIII	9.6	11.9	0.81	79.67	4.7	5.9	2.04	3	2.9	4.4	5.4	3.6	1.3	1.9	1.4	1.9	1.3	28.07	36.18	21.91	61.26	58.09	147.42
	mXI	10.2	12.2	0.84	71.14	5.1	6.8	2.00	2.4	3.3	4.1	5.9	3.1	1.3	1.5	1.4	1.9		25.11	11.04	30.76	27.69	41.8	94.6
	mXIII	10.8	12.4	0.87	91.08	6.9	7.9	1.57	2.5	2.6	4.1	5.4	2.7	2	1.7	2	1.6	2.2	53.62	0	25.1	75.52	25.1	154.24
MBS 319	mI	8.3	9.7	0.86	39.39	2.9	3.8	2.86	3.5	3		3.8	1.8	1.3	1.4		1.8	1.3	61.69			74.44		
	mII	8.8	11	0.80	85.71	5.2	4.8	1.69	3.9	3.9	4.3	5.5	3.9	1.7	1.6	1.6	1.7	1.6	31.23	32.89	38.6	50.08	71.49	152.8
	mIV	9.2	11.8	0.78	71.4	4.1	5.3	2.24	4.8	4.5	5.6	5	2.8	2	2	1.7	1.6	2	19.86	32.06	34.91	59.17	66.97	146
	mV	9	11	0.82	64.49	3.5	5.2	2.57	3.2	3.3	5.1	6.2	2.9	1.5	1.5	1.2	1.7	1.7	34.71	22.12	36.42	47.47	58.54	140.72
	mVI	7.9	8.9	0.89	84.64	3	4.9	2.63	2.6	3.2	5.2	5.1	2.8	1.7	1.5	2	2.2	1.2	53.11	35.38	33.69	85.27	69.07	207.45
	mVII	8.1	9.9	0.82	70.87	4.1	4.3	1.98	2.7	2.8	2.4	5.6	3.2	0.9	1.5	1.1	1.2	1.5	31.95	67.54	43.7	57.94	111.24	201.13

NS 43-311	mI	9.1	8.7	1.05	57.75	4	3.9	2.28	1.4	3	5.2	4.4	2.7	1	1.3	1.7	1.4	1.9	23.07	23.87	19.94	86.77	43.81	153.65
	mIII	8.2	9.8	0.84			4.7		3.1	2.6			2.5	1.1				1.3	42.32	45.5	23.75	88.85	69.25	200.42
	mIV	10.4	10	1.04	76.28	4.1	6.6	2.54	2.6	3.4	5.2	3.6	2.4	1.6	1.2	1.4	1.4	1.2	27.8	8.59	0	142.23	8.59	178.62
MUSE 7086	2 mIV	9.3	14.9	0.62	99.69	4.7	9	1.98	4.4	3.8	6.3	6.5	4.3	1	1.3	1.6	1.8	2.2	12.65	29.16	18.01	53.51	47.17	113.33
	2 mVIII	9.3	12.3	0.76		2.9	9.1	3.21	0.9	1.9	6.5	3.4	2.1	0.3	0.7	1.3	1.1	1.3	30.03	7.7	0	60.2	7.7	97.93
	2 mXII	10.2	9.1	1.12	57.27	4.9	6.1	2.08	3.6	3.8	4.2	4.7		1.1	1.2	1.6	1.3		3.12	17.39	8.97		26.36	
	2 mXIII	6.2	11.6	0.53	86.91		6.4		3.7	3.5	3.6	4.9		1.1	1.3	1.7	1.7		41.24	6.22	52.26		58.48	
	3 mV	11.8	13	0.91	70.67					4.4	4.4	6.3	2.2		1.7	1.6	1.6	1.3		4.82	3.98	94.07	8.8	
	3 mVI	7.3	11.1	0.66						2	2.9	6.3	2.6		0.9	1.2	1.6	1.2		2.3	0	36.15	2.3	
	3 mVII	10.5	18.4	0.57	79.82	5.1	10.5	2.06	2.4	3.6		5	3.1	1.3	1.4			1.8	47.03	11.58		72.26		135.07
	3 mVIII	9.3	14.7	0.63	63.48	4.9	8.5	1.90	5.5		5.8	4.7	5.4	1.8		1.3	2.2	1.5			43.67	37.09		103.99
av		**8.7**	**10.4**	**0.86**	**75.62**	**4**	**5.5**	**2.35**	**2.7**	**3.1**	**4**	**4.9**	**2.9**	**1.3**	**1.3**	**1.4**	**1.5**	**1.5**	**40.77**	**30.86**	**30.43**	**58.64**	**61.7**	**163.27**
min		**3.4**	**3.7**	**0.47**	**39.39**	**0.8**	**1.8**	**1.41**	**0.9**	**1.2**	**1.2**	**1.7**	**1**	**0.3**	**0.6**	**0.5**	**0.6**	**0.6**	**0**	**-16.15**	**-7.23**	**8.78**	**2.3**	**65.83**
max		**14.9**	**18.4**	**1.70**	**106.26**	**8.5**	**11.9**	**5.37**	**5.5**	**8.6**	**10.3**	**11.6**	**6.7**	**3.5**	**2.9**	**2.5**	**5.7**	**3.3**	**100.86**	**67.54**	**84.29**	**142.23**	**111.24**	**275.82**

Measures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
CT 2	2	87.2		42.8	83.71	18	38.8	23.6	56.4	-10.67	68.8		41.1	92.39	25.8	31.8	18.3	46.9	7.97	29.6	5.52	0.74	70.2	1.24
		94.9	80.4		89.86	69.1	41.6	27.2	53.6	-27.65		52			42.7	29.3	16.9	45.2	-15.71	38.5	6.01	1.45		
		78.2		50.6	85.47	25.8	43.4	29.6	54	-34.16	81.1								0	13.1	4.95	0.98		
		82.2	63.8		95.06	51.9	37	24.7	55.7	-15											5.20		58.2	1.41
				46.8		30.3	36	23.6	55	-62.53			54.6		46.6	28.6	16.6	43.4	28.07	14.7		2.62		
										-10.03									0	29.7				
MSNM 27	1	108.8	73.3		102.44	61.6	39.6	22.4	42.8	-6.81	101.4	73.2		105.49	64.7	33.7	21.3	42.3	0	12.3	6.63	5.13	75	1.45
		109.6		65.6	102.64	46.7	46.4	30.2	53		103.8		53.9	102.84	36.7	39.8	24.4	48.8	13.51	17	6.68	2.45	60.3	1.82

		101.4	74.2		98.35	63.7	41.8	23.6	57.7	25.58		77.5			67.1	38.9	24.2	52	30.1	5.5	6.18	11.89		
				55.3		37.3	41.7	24.4	54	0									6.4	10.1		1.85		
										9.74														
	2		74.4			51.8	53.2	34.7	63.8	0		68			52.7	43.2	30.7	58.7	24.04	13.1		3.99		
										7.87									16.73	13.1				
NS 43-5		105.9		70.1	102.76	61.6	33	19.2	54.9	22.15	130.4		68.5	149.71	66.3	16.7	2.4	27.9	50.78	3.4	4.67	18.81	92.8	1.14
			65.6			43.1	49.5	34	71	0		65.6			64.1	17.6	9	30.6		15.9		3.37		
										-11.78									33.55	25.6				
SV 13-28b	1	79.5	61		87.35	39.9	45.9	35.7	63.6	11.62											6.12		59.3	1.34
		75.5		53.7	94.64	38.9	36.8	25.7	54.1	49.61	67.7		51.3	85.91	36.8	35.8	25	47.8	7.68	21	5.81	1.80	48.9	1.54
		73.7	48.8		95.26	36.6	32.3	17.2	46.7	-36.29	71.8	47		93.19	30.6	36.2	26.1	47.9	9.2	18.9	5.67	1.78	57.8	1.28
		66.2		50.6	87	36.9	34.6	22.3	50.9	4.66			52		41.1	31.7	22.1	47.4	28.35	13.2	5.09	2.95		
			44.9			29.2	34.1	22.3	51.6	-30.88									30.78	17.8		0.82		
										-1.8														
	2									-2.3									13.21	13.3				
		58.3								9.41	57.8								-5.49	13.1	5.25			
		63.9									65.1								-3.11	13.1	5.76			
		61.3	40.5		115.48	34.8	20.7	16.3	24.5		66	35.4		127.57	30.7	24.2	17.7	25.7		9	5.52	3.64	39.5	1.55
		68.2		35	112.82	29.1	19.5	13.7	24.1		63.9		37.3	131.19	34.1	14.9	8.6	23.7	0	14.5	6.14	2.18	36.2	1.88
			38.7		107.3	32.2	21.3	13.7	30.6			35.3		116.81	31.9	15.2	9.2	25		13.9		2.31	47.2	
				45.7		35.4	28.7	21.8	37.8				39.6		31.4	24.4	12.2	33.1	7.84	9.6		3.48		
V 2856	1										69.8		48	94.83	31.8	35.9	24.6	48.4	9.65					
		73.8	55.8		88.65	39.5	39.4	24.9	53.8	-7.63	73.3	46.5		109.04	37.3	27.9	18.3	40.4	8.38	18.5	5.59	2.08	44.1	1.67
		71.7		49.6	84.19	34	36.1	23	52.8	-2.83	79.4		43.4	105.58	36	24.3	16.1	37.6	28.79	16.5	5.43	2.12	54.4	1.32
		71.5	57.1		84.37	37.3	43.1	33.6	56.3	31.44	76.3	55.9		94.74	42.7	36.1	26.9	50.2	8.95	18.3	5.42	2.19	62.1	1.15
		77.7		49	97.98	33.6	35.4	26.9	45.9		78.8		47.5	100.48	33.6	33.8	23.3	48.2	17.59	22.7	5.89	1.48	54.2	1.43
		64.7	54.2		76.6	44.1	31.5	21.1	45.2		57	55.2		71.18	45.1	31	20.2	46.7	20.9	22.5	4.90	1.98	54.8	1.18
				49.8		18.8	45.8	33	58.2	0			40.4		11.2	38.6	25.1	54.1	63.43	24		0.63		
										23.81									7.39	17.4				

	2	71.1	68.2		65.65	32.3	53.5	39.8	70	-15.22	72.9	54.8		80.19	34.3	42.9	31.8	56.6	30.96	15.8	4.77	2.11	49.8	1.43
		68.5		67.8	61.45	38.4	59.6	37.4	75.4	0	73.2		58.2	79.76	38.7	43.3	31.1	57.8	47.69	16.5	4.60	2.34	55	1.25
		70	66.7		63.41	30.1	55.8	38.9	76.5	-34.51	71.2	55.9		79.71	34.5	44	32.8	57.5	-2.83	18.6	4.70	1.74	54.5	1.28
				66.7		39.5	53.8	34	68.8	32.64	65.1		55.3	75.23	36.7	41.2	30.6	52.3	11.55	22		1.73	48.4	
										-2.64		52			28.7	43.2	31.2	57	-2.58	18.7		0.77		
																			19.93					
V 7006											33.5		22.9	96.88	19.2	12.3	8.2	18.1	53.75					
		28.3	25.1		65.88	14.3	20.6	15	26.6	13.8	32.7	21.7		91.36	14	16.4	12.4	22.9	39.81	11.9	4.16	1.19	28.4	1.00
		26.2		26.8	55.16	13.9	22.9	16.7	29.8	27.47	34.2		24	93.17	18.7	15	10.8	21.6	53.67	11.5	3.85	1.42	30.2	0.87
		33.9	29.3		66.79	11.9	26.8	19.7	34.2		29.6	23.1		77.21	15.4	17.3	12.7	23.5	45	17.3	4.99	0.79	33.3	1.02
				31.9		21.8	23.4	15.8	30.1		41.2		24.3	89.91	14.1	19.6	14.9	25.9	42.4	19.9		0.90	34	
		33.9									34.2	33.2		72.42	27	19.2	13.8	25.5	46.61	12	4.99	1.13		
											30.6		23.3	76.25	7	22.2	17	27.1	61.39					
												26.1			22.4	13.2	8.7	15.3	32.91	12.4		0.90		
V 7012		78.4		47	104.13	36.4	29.4	21.9	34.8	-18.6	73.6		48.6	100.93	37.8	30.4	22.9	40.6	28.61	12		3.09	50.5	1.55
			52.8			42.1	31.8	23	41.7	18.89		46.6			35.7	29.9	22.6	40	25.27	13.7		2.84		
										9.53									31.39	10.4				
V 7039	1	65.5	50.7		65.6	29.2	41.3	30	53.6	-3.5	64.1	43.8		87.46	26	35.3	29.5	44.7	48.99	13	7.04	2.12	46.3	1.41
		68.6		48.3	92.34	35.8	32.3	20.7	43.8	-45	78.5		48.4	100.54	37.8	30.5	22.9	38.6		7.9	7.38	4.66	35.8	1.92
		64.5	46.2		82.48	32.5	32.8	22.2	44.2	0	63.5	53.7		80.1	40.8	35.1	26.7	46.9	42.09	10.1	6.94	3.63	51.7	1.25
		66.7		51.2	84.94	31.8	40.4	30.5	48.9	-20.85	60.6		44.3	83.88	22.7	38.1	30.2	49.6	49.59	18.6	7.17	1.47	42.8	1.56
		67.5	47.1		96.63	35.6	31	21.9	41.1	32.01	67.7	46.1		97.26	38.1	25.8	18.8	38.5	32.52	11.9	7.26	3.10	34.1	1.98
				44.7		29.7	33.3	21.3	43.3	18.63			44		27.2	34.5	27.3	47.8	34.2	11.7		2.43		
		67.7								-12.36	69.4								30.31	8.8	7.28			
				52.6		38.3	36	27.3	41.8															
										-7.39	62.8	49.9		81.88	36.1	34.1	26.2	43	21.8	10.9		1.66	37.4	
										-34.88			45.6		26.2	37.1	28.7	44.3	0	8.4		1.56		
											64.3								21.61					
																			70.02					

	2										64.1		41.8	97.24	32.3	26.4	20.2	34.5	39.38					
		74.9	46.7		92.41	30	36	25.3	46.1	0	82.7	43.5		103.6	31.8	30	22.5	38.3	14.21	8.9	6.24	3.47	53	1.41
		78.3		57.1	90.57	45.5	34.5	22.6	46.5	7.18	77.6		57.5	99.24	47.9	31.5	22	40.5	34.51	9.1	6.53	5.13	43.7	1.79
		61	53.1		67.47	32.5	41.8	30.8	52.8	15.85	63	43.1		85.56	29.3	31.5	20.7	47.4	18.9	11.9	5.08	2.60	46.7	1.31
		75.4		57.2	72.45	27.9	50	39.6	62.5	13.26			49.5		33.7	35.9	25.1	56.2	19.91	11.8	6.28	2.61		
			69.5			47.5	51.3	41.5	63.2	-28.19	64								16.05	15.3		1.55		
		71.6								21.52											5.97			
											72.9	64		88.1	51.7	37	27.7	41.3	71.57					
										8.9			36.9		21.1	30.7	22.4	38.6	29.25	6.3		1.67		
																			-5.31					
V 7063		48.5								28.51	46.8								46.91	7.4	8.66			
		53.4	31.4		121.34	26.6	16.7	12.7	22.1	14.83	53.3	28.2		135.03	25.3	12.5	7.8	17.8	38.11	6.8	9.54	3.82	29	1.84
				29.8		26.7	13.2	9.7	18.3	0			29.3		27.9	9.1	5.1	14.6	32.66	4.8		5.69		
										-2.18									61.82	6.7				
V 7072		71		58.7	74.5	35.6	46.8	36.3	61.7	-69.23			53.8		40.9	34.8	28.1	44.8	33.9	11.4	5.59	3.36		
			58.5			35.3	47	36.3	61.4	-65.73									-21.04	14.3		1.23		
										-58.92														
V 7073	1										31.5		24.1	80.67	16.4	17.5	11.9	22.9	18.43	9		0.91		
		27.5	27.5		63.66	20.5	18.4	11.8	24.1	37.79	31.9	24.3		75.17	14.9	19.2	14.8	23.6	34.51	3.9	3.99	4.54	23.2	1.19
		31.8		24.3	62.67	6.7	23.5	17.9	29	15.32	39.6		27.5	71.26	16.8	21.8	16.7	26.6	38.16	12.9	4.61	0.91	25.3	1.26
		26.9	34.4		51.23	29.7	19.9	15.4	25.9		33.1	38.5		58.69	28.2	23.6	18.8	29.1		11.7	3.90	2.47	28	0.96
				21.2		-7.8	19.8	14.5	25.3				23.9		0	23.7	18.7	28.6	10.03	18.7		-0.21		
	2	54.7									54.2	30.4		122.73	27.3	13	6.9	18.2		8.5	10.73	1.61		
											51.7		31.5	115.16	26.8	16.7	11.3	22.9						
			36.3			28.3	22.9	15.5	29.1	-12.14		29.7			25.1	15.7	10.6	22.9	34.51	6.9		3.87		
		41.1								-10.75									41.42	6.6	8.06			
MUSE 5721		65.1	23.3		85.53	10.2	20.8	10.3	36.7		63.8	22.4		83.76	7.3	21	10.5	35.2	-9	18.1	3.83	0.48	41	1.59
				62.6		54.2	31.2	18.1	50.3	-78.69			62.2		56.6	25.6	18.1	41	-55.22	14.8		3.74		
		84.4								-16.8	85.3								-12.09	16.3	4.96			

		86.1	44.6		103.34	31.5	31.3	18.5	48.1		83.5	39.2		117.72	31.2	23.5	12.7	39.8		17.4	5.06	1.80	47.1	1.83
		88.5		64.5	101.81	54.5	34	19.3	54.9	-27.05	87.8		57.9	112.23	52.5	24.6	12.5	38.3	46.4	19.5	5.20	2.74	62.1	1.43
			48.8			33.7	35.4	20.7	52.7	-14.89		47.6			34.9	32.5	16.9	44.7	-5.44	14.7		2.33		
										-2.74									-33.69	16.3				
PDVcII 13		66		54.7	96.96	48.3	25.1	14.6	40.9	-20.9			52.5		48.8	19.4	10.8	30.6	6.2	12.4	4.65	3.92		
			31.5			17.8	25.9	14.1	35.1	-9.56									23.4	14.2		0.63		
		71.7								2.7											5.05			
										-6.79														
PDVcII 16											52.4	59		54.91	26.6	52.5	36.1	72.2	5.61					
		59.2		56.8	66.94	35.6	44.2	30.8	63.3		59.2		54.4	66.45	25.7	48	30.8	67.8	32.59	25.6	5.15	1.20	48.2	1.23
			49.6			23.5	43.7	26.1	62.3	7.91		53.6			33.1	42.1	26.8	59.7	13.07	15		1.89		
										8.93									-7.09	24.3				
PF 8	1			32.5		25.8	19.5	16.5	26.6				31.8		29.8	10.8	5.2	14.9	19.55	10.4		2.67		
		37.5								-17.76	32.8								41.11	14	4.81			
		39.6	20.8		87.78	9.8	18.4	14.2	22.2	0	36.2	16.4		104.51	11.4	11.8	8	16.9	68.55	10.2	5.08	1.04	31.5	1.26
				34.8		32.2	18.1	14.8	24		45.1		28.6	135.48	25.9	12.6	10.1	17		9.6		3.03	24.2	
		38.8									44.5	19.9		126.71	16.8	10.6	7.9	15.1	11.43	6.4	4.97	1.31		
										2.02	43.5		29.5	128.6	27.6	10.6	6.9	14.6						
												18.4			15.8	9.6	5.2	13	0	10.4		0.76		
											51.6													
		33.3		28.4	85.53	24.8	14	9	17.7	-2.9	36		23.9	103.75	21.2	11	6.3	15.1	15.83	8.9	4.27	2.58	21.9	1.52
		37	19.7		88.93	9.1	17.5	12.4	21.7		39.6	21.5		101.02	14.3	16.2	12	20.1		5.3	4.74	2.21	33.3	1.11
		35.6		31.7	90.28	27.9	15.2	9.5	19.1	3.77	33.6		29.4	87.51	25.3	14.9	11.5	18	53.9	10.6	4.56	2.51	19.2	1.85
		38.9	15.7		93.12	7.6	13.9	9.7	17.1			17.3			8.3	15.2	11.5	17.9		8	4.99	0.99		
				34.8		31.2	15.2	11.1	18.7											8.8		1.77		
	2										44.9		23.1	114.64	17.7	10.1	11.8	17.9						
		40.2	32.5		98.75	27.6	17.1	11.9	21	-2.88	42.1	30.1		119.55	27.2	12.3	9.3	16.7	-5.08	5.1	6.09	5.37	18.8	2.14

		43.5		19	102.07	12.7	14.3	9.6	17.9		42.3		18.1	120.92	14.7	10.3	6.7	14.4		5.8	6.59	2.36	30.9	1.41
		45.5	35.3		106.92	31.1	16.8	12	20.1	-9.46	44.9	30.2		126.32	27.5	13	10.4	15.6	8.43	7	6.89	4.19	27.6	1.65
		37.7		20.1		14.3	14.1	9.1	18.4		41.3		20.1		17.4	14.8	8.6	12.7		5.4	5.71	2.94		
										-4.76										6.7				
										10.92									22.16	10.9				
	3	47.5								-3.07	51.4								17.1	8.5	6.01			
		49.1								-8.35	48.3								31.49	11.6	6.22			
										0										11.6				
MBG 8848		44	52.2		47.93	7.5	51.7	42.5	61.5	4.75	44.7	51.3		47.78	4.9	50.9	41.5	59.2	6.16	13.2	4.11	0.47	25.9	1.70
		54.9		56.1	62.38	35.7	43.1	32.3	48.6	2.42	54.6		58	62.11	39.1	42.8	32.7	51.2	15.35	11.3	5.13	3.31	38.1	1.44
		55	49.5		61.14	19	45.4	34	55.6	4.81	53.4	45.3		61.25	15.5	42.8	32.1	55.9	3.34	14.3	5.14	1.21	37.7	1.46
		60.5		57.6	71.54	35.8	45	35.9	62.2	-52.13	63.6		57.2	79.67	37.8	43.2	32.7	55.6	42.44	12.4	5.65	2.97	46	1.32
			44.3			24.2	37.2	29.2	48.8	-22.62		39.2			24.5	30.6	18.5	38.4	-21.98	13		1.87		
										-10.22									41.23	16.8				
MBG 10117		84.7								-2.77	78.5									21.9	7.74			
		81.6	46.3		103.24	33.4	32	20.5	45	-8.91	80.5	42		123.4	35.4	22.4	14.6	30.1	27.27	15.1	7.45	2.28	53.7	1.52
		80.6		57.4	103.74	48.4	31.2	23.2	39.4	14.99	83.1		49.2	123.73	44.9	21.1	13.8	24	45	17.6	7.36	2.65	54.7	1.47
		80.9	44.3		107.57	32	30.8	24.4	34.5		78.2	44.9		116.69	37.9	24	18.5	29.1		14.4	7.39	2.43	57.1	1.42
		82.5		55.7	107.28	48.6	27.2	17.3	35.1		80		47.2	120.67	40.6	24.4	15.1	35.3	9.28	19.4	7.53	2.30	53	1.56
			46.5			33.5	32.1	21.6	45	-3.69		44.8			39.3	21.3	10.7	28.7	6.89	11.2		3.25		
																				19.3				
MBG 12465	1			54.3		39.7	37.6	31.5	44.4				48.9		39.1	29.6	23.7	36.7	46.85	13.2		2.98		
		57.9									62.7									11.3	6.98			
		66.8	39.6		104.87	28.5	27.4	21.3	37.3		60.4	36.7		115.42	29.6	21.5	14.4	28.4		16.2	8.05	1.79	47.6	1.40
		72.9		44.5	112.42	38	22.7	17.3	32.2	-15.02	65.9		35	119.65	30.6	16.6	9.8	23	43.71	17.5	8.78	1.96	38.4	1.90
		67.4	43		104.32	35	26.1	19.5	33.2		70.4	41.4		119.05	35.1	21.5	13.9	26.4		10.2	8.12	3.44	57.6	1.17
		68.8		42.3	106.8	32.3	26.6	18.6	34.4		71.8		40.5	127.14	35.2	19.3	12.3	25.4	19.8	9.9	8.29	3.41	36.1	1.91
		71.5	44.2		108.29	36.4	25.4	17.9	34.9	0	66	39.6		125.91	36.4	15.9	9.3	24.7	10.91	13.9	8.61	2.62	52.3	1.37
				44.2		35.3	25.7	18.5	34.4				34.1		29.5	16.9	10	27.9	38.11	13.1		2.47		

		71.8								14.34	74.3								14.74	8.6	8.65			
		69.2	47.3		102.1	36.7	30	21.3	37.9	8.37	71.5	46.2		116.31	40.3	24.9	21.1	31		8.9	8.34	4.33	55.2	1.25
		66.4		41.7	104.53	32.6	25.7	19.1	35.6	-3.69	68.7		37.7	118.45	32	19.5	12.7	29	36.71	13.1	8.00	2.47	30.8	2.16
		71.8	42.3		106.15	34	25.7	22	36.6		70.2	42.4		118.97	36.6	21	13.9	30		10.7	8.65	3.30	62.7	1.15
		71.8		46.9	111.35	37.4	27.6	20	35.9		71.4		39.6	122.71	34.2	20.2	13.9	28.4	46.77	14.4	8.65	2.49	32.3	2.22
		66.9	39.9		106.62	33.9	21.2	14.1	32.2	0	73.3	42.1		120.12	37.4	18.7	13.7	28.3	0	10.1	8.06	3.53	54.2	1.23
		74.3		43.7	110.78	32.9	28.3	20.7	40.5		70.5		42.5	121.68	35.4	23.2	17.7	32.5		14.1	8.95	2.42	55.7	1.33
			47.5			40.7	22.7	16.6	31.7			38.4			34.7	15.9	10.5	22.5	32.99	16.6		2.27		
																			0	10				
	3									13.13										8.5				
		30.3	51.6		33.72	25.4	44.7	30.6	62.3	26.08	32.2	49.7		39.75	31.7	38.6	16.8	50.1		8.1	3.48	3.52	24	1.26
		24.3		52.2	20.81	4.2	52	42.3	68.9	4.5	22.8		41.7	28.09	0	41.5	24.6	53.3		11	2.79	0.19	20.3	1.20
		35.5	64.3		33.05	17.9	61.6	53.8	79.9		42.7	49.3		56.26	22.9	43.5	35.7	54.7		12.8	4.08	1.59	34.5	1.03
				59.5		16.9	57.1	47.1	73.5				35.7		17.1	31.3	21.7	36.2		14.6		1.16		
																				21.9				
		75.9	53.5		87.29	37.6	37.1	23	52.3	29.74											8.72		47.6	1.59
		69.4		56.8	75.36	37.4	42.3	29.8	66.9		77		51.7	107.52	42	30.1	21.8	44	60.26	6.9	7.98	5.75	49.1	1.41
		88.8	56.7		81.32	31.7	47.2	38.1	74.3			43.7			34.9	26.4	19.1	43.2	20.19	14.4	10.21	2.31		
		87.3		77.5	78.99	57.1	51.8	43	69.6	35.81	80.6									17.8	10.03	1.60		
		76.3	57.2		79.5	30.1	49.3	37.1	65.7	-3.99									37.87		8.77		44.5	1.71
		72.8		61.4	79.12	45.9	41	24.7	55	29.86	77.2		47.6	115.29	38.8	27.3	17.8	37.9	37.57	8.1	8.37	5.23	38.9	1.87
			52.8			26.8	45.6	28.8	59.4	13.43	81.5	43.2		109.72	38.1	21	13	33.2	50.91	9.7		3.35		
											82		56.1	92.05	42	36.9	29.1	51.5	37.87	18.9		1.11		
											68.9	57.5		68.83	39.6	41.5	32.9	54.8	48.5					
											72.6		63.7	81.1	51.5	37.3	27.6	50.6	26.51					
											64.8	46.5		74.45	21.2	41.1	32	54.7	0				48.4	
		69.7		71.3	65.36	54.4	45.9	35.4	52.7		68.7		59.1	81.22	43.7	39.8	30.1	53.2	14.24	19.3	8.01	2.54	49.4	1.41
		67.4	55.6		67.37	14.9	53.5	42.2	58.6		76.4	45.6		100.39	25.1	37.9	28.4	50	22.63	9.1	7.75	2.20	37.8	1.78
		43.5		65.5	39.28	6.6	65.4	52.7	61.6		50.4		54	54.52	18.8	50.3	39.3	57.1		21.8	5.00	0.58	48.8	0.89

		69	63.6		67.18	35.6	53	43.2	63.5		62.5	55.7		73.48	31.2	46.1	34.7	57.6	23.78	18.5	7.93	1.81		
				60.8		33	51.1	43.3	61.1				48		30.6	37.1	25.6	50.1		18.4		1.73		
																				10.3				
	4	80.9	43.7		100.75	33	28.8	24.2	34.4												9.69			
		74.3		60.8	88.13	23.5	37.3	32.9	45.2												8.90		62.8	1.18
		69.3	45.4		91.23	26.8	36.7	29.5	45.2		60.3	33.1		120.32	27.1	19.3	14.1	29.3	39.51	22.2	8.30	1.21	48.1	1.44
		72.3		51.9	98.22	42.3	29.6	19.6	37.3	-20.73	63.4		36.4	124.28	32.9	15.1	8.5	24.9	27.26	20.7	8.66	1.82	42.3	1.71
			43.3			29.8	31.7	23.4	39.8	-13.07	79.3	35.6		124.08	30.3	19	13.2	26.9		12.9		2.33	53.7	
		81									86.2		54	125.95	49.1	21.5	16.9	27.1		12	9.70	2.05		
											76.5	42.6		123.47	36.9	21.3	15.9	29	34.33					
		75.1		53.8	98.82	44.5	28.4	17.8	41	-20.22	78.2		44.1	125.18	39.3	19.8	14.4	29	21.1	16.3	8.99	2.57	46.7	1.61
		76.1	44.6		97.23	31.7	32.5	23.7	42.7		76.9	44.2		121.47	38.8	21.2	15.6	30.1	15.07	11.8	9.11	2.99	59.6	1.28
				56.5		44.9	31.7	25.2	38.3				43.7		38.1	21.8	15.7	29.1	5.75	20.6		2.01		
																				11.7				
	5	76.9		55.6	97.35	43.2	34.7	28.6	41.1	27.15	90.2		57	125.96	50.1	26.4	18.6	35.6	20.1	4.3	8.31	10.85	55.9	1.38
		77.7	47.1		105.78	33.7	32.3	24.9	41		76.4	44.5		127.07	39.8	19	10.2	30.3		9.7	8.40	3.79	44.2	1.76
		77.8		50.3	109.7	43.5	25.7	17.3	35.6	1.74	69.9		40.7	119.78	36.6	18.1	9.8	25.9	45.76	17.3	8.41	2.32	42.2	1.84
		76.4	45.1		107.05	34.7	28.3	19.5	37.8	-17.74	73.5	39.9		123.45	33	22	15.2	31.5	40.46	8.1	8.26	4.18	54.4	1.40
				50.3		42.8	27.6	19.3	38.9	21.54	77.9		43.9	126.68	40.5	16.6	10.3	27.1	24.27	10		4.17	29.6	
		86.2									83.6	43		128.06	36.9	21	14.2	27.1			9.32			
													50		46.6	15.1	12.4	24.7						
																			50.71	7.7				
MBG 12480											73													
										-9.56									17.57	17.6				
		65.1		68.8	64	45.9	50.6	40.5	60.6	-12.09	61		54.4	72.28	34.2	41.8	33.5	51		27.7	5.21	1.45	50.3	1.29
		69	51.3		76.9	19	47.9	36.9	58.3	-6.01		48.8			26.6	40.8	30.3	62.8	11.89	13.3	5.52	1.71		
		63.8		58.9		48.6	33.4	21.3	45.9	-8.13									17.93	23	5.10	1.06		
		61								15.61	60.3										4.88			
		60.3								-50.51	59.3								0	19.5	4.82			

										-29.51									-11.41	16.3				
										-11.52									-7.6	18				
MBG 12520		64.1	52.9		78.49	38.1	36.4	24.6	39.6	-3.98	63	43.9		93.17	33.2	28.6	18.8	38.6	14.28	10.7	6.22	3.33	29.1	2.20
		56.7		47.6	63.77	25.7	40	27.1	45.4	23.69	62.3		42.7	80.16	30	30.3	19.8	42.2	37.44	8.7	5.50	3.20	41.7	1.36
		55.7	58		60.33	30.1	49.4	35.2	62.8	0	57.7	52.8		69.34	31.1	42.9	31.8	56.8	33.69	10.2	5.41	3.00	39.5	1.41
		59.4		52.9	63.8	25.4	46.1	32.3	61	0	58.7		48.3	71.9	26.4	40.4	28.1	54.3	22.57	11.3	5.77	2.29	40.5	1.47
		63.5	59		64.55	33.7	48	32.6	60.4	-7.13	62.7	51.8		77.9	32.3	40.4	28.9	54.3	13.27	12.1	6.17	2.73	46.1	1.38
		65.7		60.1	63.22	29.9	52.2	38.1	63	0	65.6		48	81.7	30.5	37.3	25.8	47.8	17.88	11.7	6.38	2.58	40	1.64
		62.5	64.5		61.18	35.8	53.7	39.6	63.6	5.4	63.8	51.8		76.85	35.1	38.4	25.8	47.6	28.94	14.5	6.07	2.44	43.9	1.42
		61.9		57.3	62.33	26.2	51.1	41.5	61.3	0	63.2		50.3	74.07	28.4	41.5	31.8	53.8	16.19	11.7	6.01	2.33	40.3	1.54
		61	62.2		60.15	35.5	51.2	41.9	61.8	-7.22	62.6	54.6		72.85	34.8	41.9	31.8	54.9	13.76	12.9	5.92	2.72	45	1.36
		65.8		60.3	65.04	25.9	54.5	40	66	9.74			50.8		27.9	42.6	30.5	56.4	8.49	13.1	6.39	2.05		
		67.3	62.4		66.01	39.6	48.1	32.9	55.5	-3.3	65.3								9.69	15.1	6.53	1.31		
				60.4		27.3	53.9	37.2	60.2	-10.54														
										16.28									20.56	13.5				
MBS 319		55.2		39	72.92	21	33.2	22.1	44	15.79	60.9		38.1	81.84	23.1	30.3	20.3	41.5	0	11.1	5.21	1.99	38.3	1.44
		58.2	52		71.54	33.5	38.5	27.9	51.6	-4.26	56.5	53.3		71.59	36.8	37.6	32.5	49.4	19.51	14.4	5.49	2.44	47.8	1.22
		61.8		47.3	77.7	24.5	40.9	28	56.4	20.85	55.6		42.7	74.66	20.1	37.8	30.5	48.4		16.4	5.83	1.36	40.9	1.51
		59.2	51.3		81	37.6	33.7	23.7	47.2	-7.38	60.4	48.6		82.54	34.8	32.2	21.9	43.3	14.8	13.3	5.58	2.72	37.9	1.56
		55.2		38.8	76.32	21.4	32.3	20.3	43.7	0	58.3		42.7	79.26	25.7	35.1	26.2	47.1	16.66	10.6	5.21	2.22	43.2	1.28
			49.4			33.5	36.1	21.8	47.4	-13.93	59.9	48.2		80.25	33.2	34.5	26.7	45.9	19.98	13.4		2.49	40.7	
										-7.08			44.5		26.8	36.5	25.1	48.1	15.8	13.4		1.00		
NS 43-311		46.8	25.8		110.5	21.5	14	8.8	25	-15.52	51	34		102.49	26.2	21.8	13.1	25.1	-11.49	16.6	4.98	1.44	39.1	1.20
		49		30.7	91.67	24.8	18	11.9	25.6	-16.17	42.2		31	85.26	24.6	18.7	10.2	23.5	19.15	19.8	5.21	1.25	43.2	1.13
		53.4	38.6		78.77	22.3	31.4	19.9	41.1	-2.47	51.4	31.5		84.44	16.6	26.5	17.4	37.3	19.18	19.7	5.68	0.99	46.9	1.14
				45.2		31.2	32.9	20.1	43.9	-14.12	54.2		44	92.68	34.9	27.7	17.9	39.2	21.8	14.8		2.23	40.2	
										-8.91		29.6			19	22.7	12.1	32.1	51.21	17.6		0.54		
																			43.33					
MUSE 7086	2	81.7	60.6			50.4	30.3	20.3	41.7	30.49	63.3	54.1		95.35	44.5	29.2	19.5	34.5	20.71	18.4	7.50	2.58	56.5	1.45

		76.4								35.91	76.2		28	106.04	17.5	21.7	10.8	32.2	47.91	13.7	7.01	0.64		
											74.1	63.6		92.33	57.6	25.6	12.4	37.6	33.61					
		76.8								52.98	81.4		35.2	96.08	15.5	31.7	21	47.6	65.7	13.2	7.05	0.59		
												69.6			58.3	34.4	24.5	50.1	28.62					
		64.9		45.3	86.36	30.5	34.4	23.8	47.1	12.12	60.8								27.75	18.6	5.95	0.82		
		71.3	49.7			34.9	36.2	22.8	44.7	12.01	64.5										6.54			
										18.57									13.98	15.3				
		68.3		48.5	82.07	27	37.4	27.6	53.7	24.7	71								20.26	6.8		1.99		
		67.9	54.6		86.03	39.5	35.1	24	49.8	28.74											6.23		47.3	1.44
		77		43.5	88.84	27.4	33.9	17.7	48.1	37.84	70.6		52.3	80.48	31.9	42.5	27.9	52.3	18.21	10.1	7.06	2.94	48.4	1.59
			63.9			49	40.6	25.6	54.5	18.26		57.2			39.3	39.5	29.2	49.3	25.35	15.6		2.83		
										38.44									22.27	10				
	3	63.5								4.01	64.7								17.02	15.4	6.48			
										11.77									25.25	14.6				
											46.4		33.1	76.75	15	29.6	16.5	38.6	51.97					
			46.2			38.1	25.2	17.6	37.6	-3.61	62.2	41.2		92.14	30.7	26.4	16.2	39.6	-11.19	21		1.64	50.8	1.25
		66.5								36.27	65.9		45.6	85.58	33.9	32.4	24.2	49.1	16.41	13.1	6.79	1.29		
											43.7	50.7		55.75	31.2	35.6	26.2	55.5	5					
				32.2		1.8	31.5	22.1	43.7	33.55			37.5		8.4	36.1	21.9	54.2	0	13.3		0.38		
										0									35.2	20.4				
av		**64.8**	**49**	**49.5**	**84.3**	**32.3**	**35.2**	**25**	**46.2**	**-0.43**	**62.8**	**43.9**	**43**	**96.37**	**31.6**	**27.9**	**19.4**	**37.8**	**22.52**	**13.8**	**6.42**	**2.47**	**44.5**	**1.45**
min		**24.3**	**15.7**	**19**	**20.81**	**-7.8**	**13.2**	**8.8**	**17.1**	**-78.69**	**22.8**	**16.4**	**18.1**	**28.09**	**0**	**9.1**	**2.4**	**12.7**	**-55.22**	**3.4**	**2.79**	**-0.21**	**18.8**	**0.87**
max		**109.6**	**80.4**	**77.5**	**121.34**	**69.1**	**65.4**	**53.8**	**79.9**	**52.98**	**130.4**	**77.5**	**68.5**	**149.71**	**67.1**	**52.5**	**41.5**	**72.2**	**71.57**	**38.5**	**10.73**	**18.81**	**92.8**	**2.22**

Hyloidichnus bifurcatus Gilmore, 1927

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
CT 6	p	56.9	69.3	0.82	64.34	26.6	38.6	2.14	21.8	18.2	21	38.4		9.5	4.7	5.3	3.1		39.48	28.99	21.21		50.2	
LI 9	p	38.5	43.9	0.88		17.6	19	2.19			20.2	26.4	15.4			3	3.5	5			22.49	45.75		
MSNM 32	p	42.5	46.2	0.92		15.5	27.2	2.74			25.3	32.6	10.6			6.5	6.1	2.8		41.03	31.25	18.15	72.28	
UP 7	p	44	54	0.81	105.41	20.2	23.7	2.18	8.5	21.3	22.3	32.7			3.8	5.3	1.8		20.57	25.65	31.56		57.21	
	p	43.7	65.2	0.67	84.14	18.3		2.39	7.9	12.1	25	15				5.9			69.57	21.41	27.21		48.62	
PG 11	p	25.8	35.6	0.72	85.92	11.3	19	2.28	4.9	11.8	14.1	18.6	10.3		2.5	3.5	2.8	2.3	85.41	7.33	40.16	66.8	47.49	199.7
V 7053	p	43.7	42.3	1.03	43.79	19.7		2.22	10.1	22.2	24.4	15.1		3.8	6.9	6.8			12.03	20.19	9.04		29.23	
MBG 12529	1 pI	35.1	32.9	1.07					15.1	22	27.1			5.3	6.1	6.7			11.68	12.34			12.34	
	1 pII	47.8	29.3	1.63						17.4	30.3				3.8	3.3	3.1			29.88	10.73		40.61	
MBG 12531	p	56.4	40.1	1.41	76.31	13.9	29.7	4.06	13.5	23.9	36.3	44.4		6.5	7	6.4	7.1		48.09	19.7	6.73		26.43	
MBG 12532	p	47.4	27.2	1.74						20.2	32.9				6.5	6.6			44.69	25.96			25.96	
MBS 260	p	43.9	53	0.83	70.73					27.4	35.8	23.8			5.1	5.1	4.2			14.4	18.22		32.62	
MBS 10973	p	58	42.5	1.36	72.67	24	27.1	2.42		17.3	27.3	33.1	12.4		6.2	6.4	8.9	5.6		36.08	9.22	36.91	45.3	
UR 80	p	42.5	32	1.33	59.22				12.7	23.5	25.8	27.3		5.1	4.9	4	4.5		41.63	10.77	3.3		14.07	
UR 93/MBS 274	1 pI	61.7	46.3	1.33	65.01				11.2	19.8	21.7	40.4		8.4	8.2	5.6	8		34.79	21.94	2.85		24.79	
	1 pII	52.3	68.9	0.76	80.47	21.8	38.9	2.40	11.9	20.4	17.8	34	21.1				6.5	6.1	22.7	39.79	24.35	43.66	64.14	130.5
TRE 161	p	29.5	24.4	1.21	50.03	12.5	11.7	2.36	10.3	13.4	14.2	17.4	4.9	3	2.9	1.9	2.8		36.31	20.69	19.11	10.55	39.8	86.66
av		**45.3**	**44.3**	**1.09**	**71.5**	**18.3**	**26.1**	**2.49**	**11.6**	**19.4**	**24.8**	**28.5**	**12.5**	**5.9**	**5.3**	**5.1**	**4.8**	**4.4**	**38.91**	**23.51**	**18.5**	**36.97**	**39.44**	**138.95**
min		**25.8**	**24.4**	**0.67**	**43.79**	**11.3**	**11.7**	**2.14**	**4.9**	**11.8**	**14.1**	**15**	**4.9**	**3**	**2.5**	**1.9**	**1.8**	**2.3**	**11.68**	**7.33**	**2.85**	**10.55**	**12.34**	**86.66**
max		**61.7**	**69.3**	**1.74**	**105.41**	**26.6**	**38.9**	**4.06**	**21.8**	**27.4**	**36.3**	**44.4**	**21.1**	**9.5**	**8.2**	**6.8**	**8.9**	**6.1**	**85.41**	**41.03**	**40.16**	**66.8**	**72.28**	**199.7**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div

MSNM 33	m	32.9	40.1	0.82	96.52	11.5	22.9	2.86	10.6	18.5	21.4	21.5	10.8	3.3	2.7	2.9	3.6	3.3	28.22	15.66	21.97	49.43	37.63	115.28
UP 7	m	36.5	45.2	0.81	82.53	16	26.5	2.28		17.6	20.2	20.4	11.1		3.4	2.5	3.4		22.71	32.78	27.91		60.69	
	m	36.4	56.4	0.65	74.65	13.1	32.8	2.78	8.8	20.3	21.9	18.1		4.5	3.9	5	3.5		49.46	39.83	16.96	54.2	56.79	160.45
PG 11	m	22.6	33.2	0.68	73.57	11.3		2.00	6.5		12.4	9.7				2.1	1.9				19.28	33.36		100.25
V 7054	m	38.9	28.1	1.38	49.08	20.8	22.4	1.87	6.9	12.5	18.8			4	6.3	3.8			45.44	10.41			10.41	
V 7055	m	27.3	38.1	0.72	90.57	10.8		2.53			16.6	20.8	11.3			9.1	8	5		48.47	31.62	41.65	80.09	
MBG 12529	1 mII	37.3	38.9	0.96	47.9	17.7	19.8	2.11	9.1	9.8	14.2	23.8		4	4.9	4.7	5		41.59	33.94	27.17		61.11	
UR 93/MBS 274	1 mI	45.9	44	1.04	57.05	14.9	35.2	3.08	5.2		10.7	24	14.1	3.1			4.2	8.8			6.84	33.94		90.58
	1 mII	38.3	40	0.96	62.74	20.5	21	1.87	10.1	8.7	17.6	13.8	10.7	7		2.5	2.5	4.7	90.15	20.54	8.53	66.63	29.07	185.85
av		**35.1**	**40.4**	**0.89**	**70.51**	**15.2**	**25.8**	**2.37**	**8.2**	**14.6**	**17.1**	**19**	**11.6**	**4.3**	**4.2**	**4.1**	**4**	**5.5**	**46.26**	**28.8**	**20.04**	**46.54**	**47.97**	**130.48**
min		**22.6**	**28.1**	**0.65**	**47.9**	**10.8**	**19.8**	**1.87**	**5.2**	**8.7**	**10.7**	**9.7**	**10.7**	**3.1**	**2.7**	**2.1**	**1.9**	**3.3**	**22.71**	**10.41**	**6.84**	**33.36**	**10.41**	**90.58**
max		**45.9**	**56.4**	**1.38**	**96.52**	**20.8**	**35.2**	**3.08**	**10.6**	**20.3**	**21.9**	**24**	**14.1**	**7**	**6.3**	**9.1**	**8**	**8.8**	**90.15**	**48.47**	**31.62**	**66.63**	**80.09**	**185.85**

Meaures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
MBG 12529	1			155.7		135.5	74.1	42.3	98.8	18.71			143.3		125.7	68	49.8	81	12.69	54.4		2.40		
										3.37									41.72	46.1				
UR 93/MBS 274	1										339.1		255.4	92.05	214	141.2	117.2	181.5						
		323	209.9		71.23	86.7	192.4	134.1	250.3	-16.8	263.1	206.9		77.35	121.6	168	143.9	221.1	-19.88	93.8	5.67	1.11	245.2	1.32
				322.1		228.3	225.9	184.6	264.8	-17.82			211.5		116.2	162.9	136.5	201.5	4.53	124.3		1.39		
																				30.1				
av		**323**	**209.9**	**238.9**	**71.23**	**150.2**	**164.1**	**120.3**	**204.6**	**-3.14**	**301.1**	**206.9**	**203.4**	**84.7**	**144.4**	**135**	**111.9**	**171.3**	**9.77**	**69.7**	**5.67**	**1.63**	**245.2**	**1.32**
min		**323**	**209.9**	**155.7**	**71.23**	**86.7**	**74.1**	**42.3**	**98.8**	**-17.82**	**263.1**	**206.9**	**143.3**	**77.35**	**116.2**	**68**	**49.8**	**81**	**-19.88**	**30.1**	**5.67**	**1.11**	**245.2**	**1.32**
max		**323**	**209.9**	**322.1**	**71.23**	**2283**	**225.9**	**184.6**	**264.8**	**18.71**	**339.1**	**206.9**	**255.4**	**92.05**	**214**	**168**	**143.9**	**221.1**	**41.72**	**124.3**	**5.67**	**2.40**	**245.2**	**1.32**

Limnopus heterodactylus (King, 1845)

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
INF 8	pII	21.7	12.7	1.71	40.88	9.8	6.9	2.21	5.2	12	12.5			3.9		2.4			60.42	0				91.99
	pIV	14.9	14.1	1.06		8.1	10.5	1.84	3.2	7.6				1.9	1.5				65.96					137.67
	pXI	21.7	12.5	1.74	89.3	8.1	11.5	2.68	2.1	5.6	11.2	13.8		2.8	1.7	2	2.7		27.34	11.75	-6.16		5.59	
	pXVII	24	13.7	1.75	60.86	10	11.3	2.40	5.8	5.4	9.3			2.4	1.5	1.4			20.84	-5.24	12.34		7.1	
	pIXX	19.5	10	1.95	60.64	8.8	9.1	2.22	3.5	4.1	6.3	5.7		1.2	1.2	1.4	1.1		22.13	0	15.83		15.83	
	pXXIII	23.9	13.7	1.74		9	12	2.66	2.7	8.8		7.5		1.6	1.7	1.5	1.4		65.72	9.84	4.55		14.39	
	pXXIV	20.7	14.2	1.46	51.84	11.5	10	1.80	5.5	5.5	6.1	8.3	3.1	1.3	1.7	1.4	1.5	2.4	19.44	6.75	4.18	48.35	10.93	78.72
CT 3	2 pIV	27.8	32	0.87	104.04	18.6	16.8	1.49	9.6	8.3		15.7	5.7	4.3	5.8			5.3	27.29	14.4	42.75	36.12	57.15	120.56
	2 pVI	28.8	26.2	1.10		16.8	17.1	1.71		5.4	8	12.3			2.6	4.1			28.93	9.09	26.75		35.84	
	2 pVII	28.1	22.4	1.25	64.29	17.3	13.9	1.62	5.7	4.8	9.8	8.8	7.5	4.5	4.7	3.6	4.9		15.41	33.52	26.84	35.72	60.36	111.49
	2 pX	20	28.8	0.69	65.25	13	20.8	1.54	5.1	5.4	7.6	8.6	4.3	4.6	5.2	5.1	6.8	4.8	42.11	20.25	27.2	24.11	47.45	113.67
	2 pXII	18.3	26.6	0.69	74.93	11	19.8	1.66	3.8	4.2	6.3	7.9		4.2	3.1	4.6	3.2		9	19.39	43.12		62.51	
SV 13-29	pI	46.2	55	0.84	65.19	21.5	32.7	2.15	13.6	18	15	15.6	15.1	3.3	4.4	3.6	4	4.4	21.14	37.98	18.11	34.79	56.09	112.02
	pII	41.8	52.2	0.80	85.42	20.5	29.2	2.04	12.8	15.1	19.6	21.7	6.9	3.9		3.4	3.4	4.1	23.11	27.52	12.27	66.39	39.79	129.29
UP 1	1 pII	44.7	41.1	1.09	63.91	23.7		1.89	10.8	14	13.4			6	6.8	5.6			19.41	11.8	25.08		36.88	
	1 pIII	49.8	30.5	1.63		21.2	24.9	2.35	12.6	18.9	21.5			7.2	7.1	5.3			13.18	22.47				
	1 pIV	48.3	38.3	1.26	97.46	31.5	27.4	1.53	8.6	18	18.6			6	5.1	6.8			36.63	3.87	31.71		35.58	
	1 pV	51.8	39.8	1.30	66.56	26.8	29.3	1.93	12.3	20.2	17.4	22.3	13.6	4.3	4.3	4.2	5.3	3.6	38.02	9.16	18.97	2.83	28.13	68.98
	2 pI	36.6	32.7	1.12	64.87	17.8	29	2.06	5.8	13.5	13.9	20	13.5	3.6		4.7	5.8	7.9	0	17.58	9.22	22.04	26.8	48.84
	2 pII	39.1	37.9	1.03		18.6	26.8	2.10	10.7	15.5	20.7				9.2	4.1			8.99	7.63	8.6		16.23	

	2 pIV	39.3			60.22	21.8	22	1.80	16.6	14.7				6.3	4.9				5.53	0				
MBG 12527	pII	49.6	51.3	0.97	78.55	33.5	38.3	1.48	15.1	19.2	15.9		11.4	6.7	9.9	8	3.7	7.8	14.07	3.58	24.05	58.02	27.63	99.72
	PIII	47.5	47.4	1.00	97.23	28.1	38.3	1.69	15.4	16.5	20.1	15.9	8.9	8.1	4.4	8.6	7.4	6.6	9.32	6.91	43.25	40.75	50.16	100.23
MBS 277	pI	21.6	29.8	0.72			17.2		12.6	10.7	11.6		5.8	3.4	3.2	3.8		1.5	4.66	33.16				96.16
	pII	24.3	20.2	1.20			11.8		7.9	9.4	8.2			3.1	5.1				5.46	-12.66	89.25		76.59	
MBS 318	p	28.6	35.4	0.81	87.12	14.3	25.6	2.00	9	15	19.8	19.1	10.2	5.1	4.6	4.8	5.6	3.6	8.79	17.81	39.36	16.48	57.17	82.44
UR 27	p	71.6	88.9	0.81	94.05	43.7	69.9	1.64	16.1	33	30.1	35.3	25	10.2	12.6	15.6	15.6	17.5	12.38	17.13	32.06	12.36	49.19	73.93
NS 43-159	1 pII	64.3	42.6	1.51	41.57	30.2	29.5	2.13	15	19.3	22.7	38.3	13.5	8.4	7.8	7.2	9.2	7	18.65	34.47	18.93	23.96	53.4	96.01
	2 pI	49.5	30.5	1.62	67.81	18.1		2.73		7	13.9	30.2			5.2	6.4	5.3			40.87	25.02		65.89	
LU1 17	p	66	66.5	0.99	87.5	31.2	43.7	2.12	22.1	28.3	35.6	46.9	11.7	9.6	10	11.4	13.1	10.7	23.37	16.01	17.16	38.39	33.17	94.93
av		**36.3**	**33.3**	**1.20**	**72.59**	**19.4**	**23.4**	**1.98**	**9.6**	**12.8**	**15.2**	**18.6**	**10.4**	**4.7**	**5**	**5**	**5.6**	**6.2**	**23.01**	**14.31**	**24.42**	**32.88**	**38.79**	**97.45**
min		**14.9**	**10**	**0.69**	**40.88**	**8.1**	**6.9**	**1.48**	**2.1**	**4.1**	**6.1**	**5.7**	**3.1**	**1.2**	**1.2**	**1.4**	**1.1**	**1.5**	**0**	**-12,66**	**-6,16**	**2.83**	**5.59**	**48.84**
max		**71.6**	**88.9**	**1.95**	**104.04**	**43.7**	**69.9**	**2.73**	**22.1**	**33**	**35.6**	**46.9**	**25**	**10.2**	**12.6**	**15.6**	**15.6**	**17.5**	**65.96**	**40.87**	**89.25**	**66.39**	**76.59**	**137.67**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	I W	II W	III W	IV W	div I-II	div II-III	div III-IV	div II-IV	div
INF 8	mII	16.1	14.2	1.13	37.87	7.1	7.8	2.27	5.3	7.5	7.5	2.8	2.9	1.7	1.4		42.64	35.95	8.26	44.21	86.85
	mIV	11.2	10.3	1.09					5.3	8.1			2	1.6			30.8	14.06			
	mVIII	12.2	8.3	1.47	41.99	6.4	5.1	1.91	2.7	3.7	6.1	5.7	2.2	2.2	1.5	1.5	58.58	21.35	13.78	35.13	93.71
	mXIII	13.9	10.2	1.36	41.19				3.9			7	1.7	1.4		1.2	33.39	6.5	11.04	17.54	50.93
	mXVII	11.7	7.6	1.54	46.85	5.4	4.5	2.17	2.6	3.2	4.2	6.1	2.5	1.4	1.2	1.5	105.26	17.16	0	17.16	122.42
CT 3	2 mIV	18.5	24.2	0.76	84.21	14.1	23	1.31	4	5.5	4.6	5	7	4.2	3.9	3.4	16.9	40.38	9.63	50.01	66.91
	2 mV	16.9	29.1	0.58	94.54	10.5	23.2	1.61	3.5	4.1	9	10	5	4.8	3.9		30	-10.07	40.66	30.59	60.59
	2 mVI	21.2	20.3	1.04	88.78	14.6	19	1.45	3	5.7	3.6	2.6	3.2	3.4	4.1	2.7	27.53	13.58	11.35	24.93	52.46
	2 mVII	21.7	31	0.70	75.06	12.2	27.8	1.78	6.6	11.4	5.9	6.1	6.2	4.7	3.4	4.9	14.14	11.49	20.07	31.56	45.7

	2 mVIII	17.8	23.7	0.75	78.05	11.7	17.9	1.52	5.1	6.3	6.6	4.3	4.7	4.8	6.8	3.7	45.82	29.45	41.88	71.33	117.15
SV 13-29	m	34.8	41.7	0.83	81.08	14	28	2.49	10.8	19.8	21.7	17.1	3.5	7.3	8.4	6.5	37.43	15	26.24	41.24	78.67
UP 1	1 mI	30.1	43	0.70	74.44	18.3	38.1	1.64	13.9	10.9	11.9	12.1	6.4	4.2	8.5	7.2	6.44	7.58	36.47	44.05	50.49
	1 mII	30.5	31.3	0.97	119.74	19.6	28.4	1.56	6.4	9.9	13.9	9.9	3.5	4.6	5.4	3.9	13.95	-2.9	19.43	16.53	30.48
	1 mIII	34	40	0.85	81.57	21.3	23.7	1.60	9.9	11.1	12.7	18.7	5.3	5.4	6.1	6.8	31.41	27.9	24.81	52.71	84.12
	2 mI	23.7	23	1.03	74.86	15.2	22.4	1.56	5.8	10	10.2	6.8	3.3	4.8	3.6	3.6	9.82	0	6.23	6.23	16.05
	2 mII	36.6	32.3	1.13	60.05	20	29.5	1.83	15		16.3	15.8	8.4		5.8	4.8	3.96	11.91	12.08	23.99	27.95
	2 mV	27.8	29.3	0.95	85.05		22.2		6.3	12.4	15.7	13.1	4.4	4.5	4.6	4.5	16.75	9	27.29	36.29	53.04
MBG 12527	mI	39.7	40	0.99	78.03	23.5	34.9	1.69	11.4	17.4	17.7	11.2	5.3	9.2	9.8	9	16.11	9.28	39.02	48.3	64.41
	mII	37.1	38.7	0.96	83.59	18.1	33.4	2.05	14.4	21.1			5.5	6.9			30.95	8.29			
MBS 277	mI	20.2	23.4	0.86	92.81	9.6	17.4	2.10	7.8	12.1	11.6	9.2	3.7	3.4	5	5	36.74	20.06	12.95	33.01	69.75
	mII	21.1	20.4	1.03	91.01	10.8	15.1	1.95	8	9.7	10.8	8.4	1.5		3.6	2.9	3.33	28.9	16.93	45.83	49.16
	m	20.6	21.1	0.98	83.46	9.7	13	2.12	12.1	10.6	11.9	8.9	2.6	2.4	1.4	2	3.35	17.61	34.92	52.53	55.88
MBS 281	m	30.1	35.6	0.85	85.34	16.9	25.5	1.78	10.5	15.2	13.9	9.4	6.4	6.9	8.7	4.5	22.17	16.65	41.71	58.36	80.53
MBS 317	m	29.4	31.4	0.94	79.65	15.4	21.9	1.91	8.4	14.6	14.3	12.4	3.8	6.3	8.2	4.1	15.22	14.96	28.79	43.75	58.97
	m	19.8	34.8	0.57	97.89	10.3	30.3	1.92	7.5	11.2	11.3	9.8	6.5	8.1	6.9	6.4	17.63	13.95	17.36	31.31	48.94
MBS 318	m	31.5	35.3	0.89	95.96	17.6	31.8	1.79	13	20.2	18	14.7	8.8	8.2	7	6.1	10.41	8.49	8.5	16.99	27.4
MBS 10987	m	36.1	31.1	1.16	97.02	17.9	28.2	2.02	13.6	15.7	19.2	9.2	7.6	7.8	5.2	7.5	14.37	13.24	22.12	35.36	49.73
MBS 11054	m	33.5	37.3	0.90	89.22	16.6	32.5	2.02		15.7	17.5	11.6		6.1	11.2			15.01	9.66	24.67	
NS 43-159	1 mI	32.1	33	0.97	53.33	18.5	23.3	1.74	10	12.9	14.4	11	7.8	6.8	4.8	4.1	42.3	25.54	16.88	42.42	84.72
	2 mI	31.9	31.9	1.00	67.74				12.1	17	22.4	17.6	2.6	2.9	3.7	3.5	7.02	16.57	22.45	39.02	46.04
NS 43-249	m	30.2	32.9	0.92	91.57	14.1	26.8	2.14	10.7	15.2	15.8	11.3		3.8	6.4	3.6	28.56	13.92	8.29	22.21	50.77
NS 43-273	m	50.5	58.9	0.86	81.82	29.2	56.9	1.73	13.4	20.1	22.2	17.6	12.8	18.2	12.2	14.7	4.22	28.99	18.06	47.05	51.27
LU1 17	m	33.9	46.4	0.73	85.46	16.6		2.04		20.8	18.3	16.9		6.6	8.6	10.1	31.2	20.59	17.23	37.82	69.02
av		**26.6**	**29.4**	**0.95**	**78.73**	**15**	**24.5**	**1.85**	**8.5**	**12.2**	**13**	**10.4**	**4.9**	**5.3**	**5.7**	**5**	**25.26**	**15.77**	**20.13**	**36.2**	**61.47**
min		**11.2**	**7.6**	**0.57**	**37.87**	**5.4**	**4.5**	**1.31**	**2.6**	**3.2**	**3.6**	**2.6**	**1.5**	**1.4**	**1.2**	**1.2**	**3.33**	**-10,07**	**0**	**6.23**	**16.05**
max		**50.5**	**58.9**	**1.54**	**119.74**	**29.2**	**56.9**	**2.49**	**15**	**21.1**	**22.4**	**18.7**	**12.8**	**18.2**	**12.2**	**14.7**	**105.26**	**40.38**	**41.88**	**71.33**	**122.42**

Measures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
INF 8		94.7	69.5		102.51	54.9	43	25.9	52.5	-60.64	98.7	66.6		117.87	56.9	34.9	20.8	42.2	0	8.5	4.53	6.58	55.8	1.70
		99.8		51.1	99.8	39.3	32.5	15.6	41.8	-3.03	96.2		48.3	115.19	41.1	24.9	11.2	32.3	-4.43	12.8	4.78	3.14	47.3	2.11
		89	70.8		94.18	60.5	36.7	22.9	48.6	-53.43	91.1	65.1		101.77	54.2	36.6	25.9	43.9	0	12.4	4.26	4.63	69.5	1.28
		86.1		49.1	98.76	28.3	39.6	23.9	52.5	-47.35	91.8		51.6	112.65	37.1	35.9	23.9	46.1	-10.24	6.1	4.12	5.36	55.7	1.55
		95.9	63.6		119.89	57.1	28.4	12.7	34.2	-22.83	91.4	58.3		121.62	53.7	22.9	14.1	35.6	31.14	15.3	4.59	3.62	50.6	1.90
		85.5		46.6	98.72	38.6	25.9	13.2	31.2	-49.24	87.8		45.8	99.76	37.4	25.9	16.6	35.2	2.14	11.7	4.09	3.25	54.7	1.56
			65			53.2	36.1	24	43.7	-56.59		67.8			55.7	31.1	20.7	36.4	38.93	10.4		5.24		
		98.7								-44.31	103.1								0	14.5	4.72			
		108.4		53.6	126.46	45	29	18.8	41.3	0	102.7		50.7	123.86	41.8	29	22.5	35.4	0	17.3	5.19	2.51	52.5	2.06
		107.4	67.9		119.33	63.3	24	12.5	36.6	-68.2	101.8	65.5		119.79	60.6	23.5	15.9	29	0	14.1	5.14	4.39	66.9	1.61
				56.6		43.5	36.6	28.1	48.1	0	88.6		51.8	110.84	40.5	32.3	25.1	38.8	16.99	11.2		3.75	66.4	
		91.3								-6.4	98.1	55.7		117.49	48.3	27.9	20	36.1	5.06	9.6	4.37	2.52		
											98.7		58.9	109.53	49.8	31.3	22.2	36.1	6.15					
		115.9	62.7		132.75	52.3	34.5	24	40.8	-58.13	107.4	62.1		121.26	48.8	37.9	27.3	40.6	3.27	15.3	5.55	3.30	69.9	1.66
		118.9		65.8	132.91	61	19.6	19	26.9	-25.38	109.4		61.2	128.49	56	27.1	18.8	33.5	-9.04	12	5.69	4.88	51.4	2.31
		99.4	50.3		116.64	60.8	25.9	12.2	32.9			60.1			56.2	21.2	16.3	29.3		8	4.76	7.31		
		94.9		64.4	111.44	38.3	32.2	17.1	42.8	-3.78	102.2								0	9.3	4.54	2.06		
		101	54.7		115.72	56.6	30.6	19.3	41												4.83			
		92.3		57.7	110.82	44.2	32.2	22.5	45.2	-2.37	98.4								2.9	10.7	4.42	2.07		
		99.9	61.9		113.42	48.1	31.7	21.5	51.3	-70.02											4.78		58.9	1.70
		110.7		66	119.79	51.8	33.9	22.4	49.4		102.6		56.5	124.32	48.4	29.3	22.5	37.6	10.78	16.2	5.30	3.09	78.3	1.41
		104.6	56.8		116.41	57.7	29.3	16.4	39.7		104.3	59.4		128.89	53.5	25.2	16.6	33.1	-5.15	11.9	5.00	4.67	50.2	2.08
		90		55.9	105.18	49.1	29.1	13.5	41.3	-29.8	93.3		56.1	129.58	52.7	19.5	11.7	25.7	10.67	9.2	4.31	5.53	61.6	1.46
			56.3			40.5	38.8	24	50.1	-5.99		47			40.8	23.4	16.9	28.3	15.95	12.3		3.30		

		114.8								-27.72	108.7									16.1	5.49			
		102.5		53.7	116.98	39.6	36.1	23.5	46.2	-5.19	106.4		56	132.01	48.9	27.6	20.8	32.7	64.65	9.3	4.90	4.76	59.2	1.73
			66			62	23.4	13.7	31.7	-6.82		60.4			57.2	19	12.9	23.9	-3.41	14.5		4.11		
										8.31									14.04	10.6				
CT 3	2	107.7	77.2		74.47	35.7	68.2	43.3	98.2			74			50.8	53.7	23	81.6	31.86	31.4	4.38	1.38		
		107.8		98.4	76.95	71.6	67.1	44.7	95	-46.04	99									36.7	4.38	0.98		
		104.7	72.1		77.41	36.1	62.3	40.3	93												4.26		85.9	1.22
		102.2		93.5	72.37	68.6	63	42.3	95.5	-22.38	99		86.1	76.12	64.7	56.2	28.1	76.9	25.35	37.7	4.15	1.77	82.1	1.24
		106.7	78.5		69.43	33.2	70.6	42.5	97.5	-21.88	104.1	73.5		79.79	33.5	65.4	34.5	79.4	35.47	32.9	4.34	1.01	98.2	1.09
		102.8		105	67.59	73.5	74.7	43.5	97.5	-50.33	95.2		87.4	77.53	69.1	53.2	28.3	71.3	12.58	34.3	4.18	2.08	71.3	1.44
		91.8	74.5		64.88	29.1	68.4	48.1	97.5	-6.93	100.3	62.3		71.46	26.1	56.6	31.3	74.2	44.48	33.9	3.73	0.81	86.3	1.06
		106.4		93.4	74.75	65.7	65.7	44.7	100.7		106.3		101	76.26	76.2	61.5	34.7	82.8	-41.63	26.9	4.33	2.64	81.9	1.30
		95.9	81		69.7	36.6	72.3	46.1	100.2	-10.23	97.2	65.2		73.8	26.1	59.6	36.4	85.3	32.2	37.9	3.90	0.83	89.4	1.07
		95.1		86.6	70.89	58.8	63.5	41.5	78.6	-46.78	99.3		92.8	76.12	71.1	59.3	38.4	75.4	12	26.5	3.87	2.45	72.9	1.30
			75.9			35.7	66.9	43.5	80.8	-27.42		63.9			27.9	57.2	38.1	71.6		38.6		0.82		
		102.2																		31.9	4.15			
										-11.79														
SV 13-29		224.8								4.67									39.89	44.2	5.11			
										21.37														
UP 19	1	185		128.9	77.09	56.6	115.8	74.3	162.6	-34.3	178.8		113.1	84.48	53.2	99.6	56.9	128.5	41.55	37	3.80	1.48	147.8	1.25
		202.4	164.6		86.48	128	103	61	140.5	-23.1	192.7	150		98.72	125	83	37.4	108	12.38	25.5	4.16	4.96	95.3	2.12
		160.6		127.6	72.14	73.8	104.3	60.6	130	-28.39			100.6		67.4	74.5	35.6	94.3	0	36.4	3.30	1.94		
			144.7			86.7	116.7	74.8	151.7	10.3									3.55	13.2		3.28		
										-29.09														
	2	205.8	123		86.04	68.1	101.9	65.7	134.8	7.65	162.6	112.5		93.08	74	84.2	50.5	102.3	7.96	45.2	5.37	1.57	126.2	1.63
		201		174.5	82.86	137.7	106.7	69.8	126.7	0			111.1		87.4	69.3	44.7	84	13.77	55.9	5.25	2.01		
			124.3			63.5	107.4	81.6	122.9		215.7									16.6		1.91		
										-7.98														

																			4.84					
MBG 12527		220.9								0	223.2								11.2	74.7	4.55			
										1.92									6.69					
MBS 277		66.5								-81.47	55.9								-25.2	24.7	2.89			
										-76.94									-5.95	14.1				
NS 43-159	1	222.5								7.84									9.51	62.1	3.46			
										-10.71														
	2									23.65									-2.05	73				
av		**119.4**	**80.1**	**80.4**	**96.32**	**56.2**	**54.3**	**34.5**	**72.5**	**-22.39**	**111.8**	**70.5**	**72.3**	**104.53**	**54.1**	**43.4**	**26.3**	**55.6**	**10.02**	**24.3**	**4.50**	**3.13**	**73.6**	**1.57**
min		**66.5**	**50.3**	**46.6**	**64.88**	**28.3**	**19.6**	**12.2**	**26.9**	**-81.47**	**55.9**	**47**	**45.8**	**71.46**	**26.1**	**19**	**11.2**	**23.9**	**-41.63**	**6.1**	**2.89**	**0.81**	**47.3**	**1.06**
max		**224.8**	**164.6**	**174.5**	**132.91**	**137.7**	**116.7**	**81.6**	**162.6**	**23.65**	**223.2**	**150**	**113.1**	**132.01**	**125**	**99.6**	**56.9**	**128.5**	**64.65**	**74.7**	**5.69**	**7.31**	**147.8**	**2.31**

Varanopus Moodie, 1929

Measures relative to the pes

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
LI 22	p	18.9	18.6	1.02	50.39	8	10.5	2.36	4.4	6.9	9.5	10.1	6.3	1.5	1.6	1.4	1.5	1.8	15.36	43.33	10.92	18.55	54.25	88.16
MSNM 34	p	41.1	35.6	1.15	57.28				6.3	10.8	18.4	16.2			3.5	3.6	2.2		62.5	-3	16.59		13.59	
SV 13-28	1 pI	13	15	0.87		4.8	11.8	2.71	3.8	6.8			3.3	1.3					15.6	14.61	22.57	52.57	37.18	105.35
	1 pII	17	14.9	1.14	56.65	6.8	7.5	2.50	3.1	6.5	9.4	10.8	3.3	0.8	1.7	1.9			28.18	17.76	20.25	32.9	38.01	99.09
	1 pIII	16	15.1	1.06		6.5	6.9	2.46	4.9	6.2	6.3		3.4	1.3	0.7	0.8			24.31	5.36	26.08	54.8	31.44	110.55
	1 pIV	17.9	15.1	1.19	53.29	7.3	8.4	2.45	2.9	6.6	9.4	10.9	4	0.9	1.7	1.7	1.9	1.7	37.75	8.85	7.62	14.41	16.47	68.63
	1 pV	16.1	15.7	1.03			9.7		4.5	6			3.5	1.1	1.3			1.2	9	6.7	22.85	100.38	29.55	138.93
	1 pVII	14.2	13.7	1.04	58.54	5.8		2.45	4	6.5	8.6			1.7	1.5	2.1			5.33	10.3				103.47

	1 pIX	17.7	10.6	1.67	56.37	5.9		3.00	4.2	6.7	10.2	11.7		1.7	1.5	1.7			23.19	25.79	11.33		37.12	
UP 1	1 pII	27.9	17.5	1.59	56.31	13.7	9.6	2.04	6.6	9.5	11.3	14.9	4.2	1.1	1.5	1.6	2	2.6	20.97	16.26	13.89	64.97	30.15	116.09
	1 pIII	21	18.9	1.11	64.8		8.6		5.3	8.2	12.7	16.1	5.9	2.4	1.3	1.7	2.7	1.9	17.87	22.54	10.46	37.85	33	88.72
	1 pIV	19.5	17.2	1.13	65.42	7.4	8.8	2.64	3.7	5.8	10	12.9	3.3	2.3	2.3	1.9	1.7	2.1	11.37	27.73	8.17	64.09	35.9	111.36
	1 pV	25.1	16.9	1.49	72.32	12.8	8.8	1.96	3.7	7.9	12.3	13.9	5.4	2.1	1.6	1.8	3.6	3	44.64	3.54	13.28	36.53	16.82	97.99
	1 pVI	24.1	16.5	1.46		9.7	10.8	2.48	3.7	5.6	12.1		4.7	2	1.7	1.4		2.4	9.69	20.49	-4.88	31.82	15.61	57.12
	2 pI	19.8	21	0.94	66.04	8.7	11.8	2.28	3.3	4.5	8	11.1	5.9	1.7	2.7	2.3	1.6	2	45.06	31.62	15.79	39.5	47.41	131.97
	2 pIV	12.7	19	0.67	107.02	5.8	8.6	2.19	4.2	4.1	5	7.2	6.6		2.5	1.4	1.9	2.4	44.12	45.71	0	70.69	45.71	160.52
	3 pI	18.2	15.9	1.14		6.7		2.72		7.4	11.3	12.4	5		1.6	1.9	2	2.8		8.91	12.92	51.15	21.83	
	3 pII	20.1	22.2	0.91	82.65	7.5	10.2	2.68	7.8	12.4	13.4	13.2	4.6	2.4	1.4	1.6	1.7	2.6	28.07	12.52	9.49	21.85	22.01	71.93
UP 2/5	pI	20.4	14.6	1.40	42.45	7.1	9	2.87	5.1	6.7	8.9	13.2	7	3.2	1.8	1.7	1.3	2.4	30.53	35.55	20.41	8.3	55.96	94.79
	pIII	15.7	18.4	0.85	71.99	6.6	10.9	2.38	3.9	5.9	7.3	8.9	5.5	1.7	3	1.4	2.2	2.2	34.19	18.45	35.59	3.58	54.04	91.81
UP 3/CT 2	pIII	22.6	17.3	1.31	46.03	9.5	9	2.38	4.5	6.9	9.3	13.2	4.7	2.6	2.6	2.2	1.6	1.8	59.25	33.31	16.93	13.95	50.24	123.44
UP 4	pI	21.3	20.6	1.03	55.59		10.9		4.1	7.4	6.9	8.5	3.6	1.7	2.4	1.8	1.8	1.7	12.26	20.21	47.7	23.57	67.91	103.74
	pIII	20.8	18.1	1.15	53.56	10.8	10.4	1.93	3.3	4.9	8.6	7.2	5.3	2.1	2.4	1.6	2.2	1.9	81.38	7.92	30.68	24.44	38.6	144.42
MBG 8834	pI	30	22.4	1.34	48.77	13.2	9.8	2.27	6.4	13	15.4	11	7.9	2.5	1.7	2.2	1.7	2.5	31.6	16.34	8.68	35.89	25.02	92.51
	pIII	28.5	19.9	1.43	59.81	13.6	10.7	2.10	3	9.6	14.1	18	7.2			1.6	2.8	3.3	32.22	20.86	15.95	20.68	36.81	89.71
	pIV	29.6	20.9	1.42	47.07	10.2	9.7	2.90	6.3	7.9	9.1	19.7	9	1.9	3	2.3	2.8	2.1	42.5	38.33	13.56	16.97	51.89	111.36
	pV	30.1	21.2	1.42	73.38	12.8	10.8	2.35	5.5	11.4	14.2	18.3	6.7	2.3	2.9	1.5	2.5	3	24.24	15.64	15.99	26.02	31.63	81.89
	pVII	23.9	20.7	1.15	69.59	12.8	12.4	1.87	5.3	9.4	11.6		4.9	3.6	2.6	3.2	2.2	2.1	21.6	14.03	22.17	27.84	36.2	85.64
MBG 10118/10132	pI	13.9	9.5	1.46	45.29	5.1	5.4	2.73	3	5.4	7.6	8.8	3.6	1.9	1.7	1.5	1.7	1.5	43.7	26.54	6.97	38.26	33.51	115.47
	pII	9.5	6.8	1.40	45					3.9	5.2	6.3	3.1		1.4	1.2	1	1.1		21.32	4.64	12.58	25.96	
	pIII	13.2	10.2	1.29	54.77	6.1	5.9	2.16	2.5	4.1	6.4	7.3	2	2.2	1.8	1.9	1.5	0.8	18.19	28.69	7.22	43.8	35.91	97.9
	pIV	7.6	9.3	0.82	76.76					2.6	5.1	6.9	3.5		1.4	1.4	1.4	1.5		31.95	0	30.65	31.95	
	pV	15.1	10.2	1.48	59.93	6.8	8	2.22	3	6.3	7.1	8.7	4	2.4	1.6	1.5	1.7	1.6	25.2	6.86	14.42	8.52	21.28	55
	pVI	10.8	12.4	0.87	59.93	4.9	7.1	2.20	4.2	5.3	6.1	6.3	3	1.6	1.6	1.7	1.7	1.2	31.68	7.72	6.02	57.67	13.74	103.09
	pXI	9.5	9.3	1.02	48.06	5.1	5.2	1.86	2.3	2.4	4.7	4.6	3.3	1.5	1.1	1.7	1.4	1.7	10.87	60.42	23.96	16.96	84.38	112.21
MBG 12465	2pII	8.5	11.4	0.75	72.06		6.8		3.5	5	6.1			1.1	1.4	1.4			57.97	9.31	10.74		20.05	
	2pIII	10	9.8	1.02	42.13	4.7		2.13		4.2	3.2	7			1.7	1	1.2			73.3	5.24		78.54	

	2pIV	8.8	9.7	0.91	54.96		6.6		2.8	3.2	3	4.2	1.6	0.7	1.1	0.7	1.1	1	10.43	35.17	28.01	15.33	63.18	88.94
	2pVI	8.3	11	0.75	75.62		7.1		2.4	5	6.3	5.8		1.1	1	0.8	1.2		24.95	12.3	30.6		42.9	
	2pVII	11.2	14.1	0.79	52.16		10		2.4	3.3	6.1	5.8	2.9	0.8	0.9	1	1.5	1	16.68	12.77	9.13	37.17	21.9	75.75
MBS 10978	pII	15.7	11	1.43	90.44	8	9.3	1.96	3	4.6	6.9	6.5		1.5	1.3	1.3	1.5		13.72	35.15	9.74		44.89	
	pIII	14.7	13.2	1.11		6.7	6.9	2.19	4.1	4.6	7.3	9.1	5.6	1.7	1.7	2	2	1.2	26.5	22.82	17.64	18.24	40.46	85.2
NS 43-104	pI	11.7	9.5	1.23						5.1	6.9	11.2			1.4	1.8	1.7			22.63	0		22.63	
	pIII	16.2	15.4	1.05	70.35	6.8	7.7	2.38	4.4	6.7	9.5	10.3	5.1	1.2	2.6	1.8	1.3	2	15.86	15.74	12.75	41.24	28.49	85.59
	pV	19	15.1	1.26	86.5	8	7.7	2.38	4.2	7.1	9.7	12.3	5.5	1.9	1.5	1.3	1.7	2.1	51.49	15.83	18.77	34.55	34.6	120.64
NS 43-148	p	49.6	41.8	1.19	77.32	25.6	28.8	1.94	13.6	12.7	22.4	22.5	8.8	4.9	7.2	6.3	4.6	4.9	12.08	20.17	28.48	23.47	48.65	84.2
ML2 8	pI	13	10.3	1.26	65.83	4.5	4.9	2.89	5.1	5.6	7.8	9.5	7.9	1	0.6	1.5	0.8	1.2	6.66	6.31	11.34	35.75	17.65	60.06
	pII	12.2	10.6	1.15	60.39	4.7	6.6	2.60	5.3	6.5	7.5	7.7	5.3	1.3	1.6	1.4	1	0.8	8.7	0	24.56	12.29	24.56	45.55
av		**18.4**	**15.9**	**1.15**	**62.26**	**8.4**	**9.2**	**2.37**	**4.4**	**6.6**	**9.1**	**10.7**	**4.9**	**1.8**	**1.9**	**1.8**	**1.8**	**2**	**27.62**	**20.93**	**15.22**	**32.99**	**36.37**	**97.34**
min		**7.6**	**6.8**	**0.67**	**42.13**	**4.5**	**4.9**	**1.86**	**2.3**	**2.4**	**3**	**4.2**	**1.6**	**0.7**	**0.6**	**0.7**	**0.8**	**0.8**	**5.33**	**-3**	**-4.88**	**3.58**	**13.59**	**45.55**
max		**49.6**	**41.8**	**1.67**	**107.02**	**25.6**	**28.8**	**3.00**	**13.6**	**13**	**22.4**	**22.5**	**9**	**4.9**	**7.2**	**6.3**	**4.6**	**4.9**	**81.38**	**73.3**	**47.7**	**100.38**	**84.38**	**160.52**

Measures relative to the manus

Sp	TR	FL	FW	FL/FW	CR	psL	psW	FL/psL	I L	II L	III L	IV L	V L	I W	II W	III W	IV W	V W	div I-II	div II-III	div III-IV	div IV-V	div II-IV	div
LI 22	m	15.2	19.8	0.77	76.24	6.8	9.5	2.24	5.5	5.7	5.2	11	4.5	2	1.8	1.8	2	1.9	9.46	26.35	24.67	68.02	51.02	128.5
MSNM 34	m	29	34.8	0.83					5.3	4.3	12.8	13		2.6		4.9	3.2		53.49	27.77	13.34		41.11	
SV 13-28	1 mI	10	10.6	0.94	87.98	2.3		4.35	2.8	5.3	7.6	7.5		1.7	2.4	2			29.56	9.83	0		9.83	
	1 mII	11.3	9.8	1.15		5.1	5.8	2.22		4	6.2	6	2.5		1.1	1.4	1.3	1.4		19.9	22.31	69.46	42.21	
	1 mIII	12.7	12.4	1.02	63.28	4.8	6.8	2.65	2.8	5.2	6.8	8.7	2.9	1.8	1.2	1.9	2.1	1.4	11.49	30.6	14.77	32.79	45.37	89.65
	1 mV	7.8	10.8	0.72	85.2				2.5	4.2	5.7	7.4			1.7	1.2	1.7		67.48	16.46	22.38		38.84	
	1 mVIII	11.9	11	1.08							6.2	7.8	2.5			1.4	1.3	1.5		13.88	25.98	35.97	39.86	
	1 mIX	14.3	13	1.10	47.36	6.1	6.9	2.34	3.1	4	4.9	8.4	3.5	2.6	1.3	1.6	2		63.16	16.39	14.12	52.4	30.51	146.07

UP 1	1 mI	21.2	15	1.41	46.33	10.2	8.2	2.08	2.6	4.3	7.9	9.9	6.8	3.1	2	1.3	2.2	2.6	37.08	24.85	14.33	22.85	39.18	99.11
	1 mII	17.6	15	1.17	70.91	8	7.6	2.20	3.5	6.1	8	9.9	5	2.1	1.8	1.9	1.5	1.8	20.49	19.45	21.95	30.09	41.4	91.98
	1 mIII	15.2	15	1.01	68.2	4.9	7.5	3.10	3.9	5.1	8.6	12	4	2.5	1.7	1.5	2.1	1.9	35.34	10.64	14.82	37.64	25.46	98.44
	1 mV	13.6	14.4	0.94	74.48		7		1.9	4	4.7	10.9	3	1.8	1.7	2	2.1		41.79	17.24	31.75	92.11	48.99	182.89
	1 mVI	17.1	12.3	1.39	47.6	8.1	6.8	2.11	4.1	3.9	6.4	9.1	3.5	2.6	1.4	1.2	2.2	1.2	77.58	29.65	7.99	44.84	37.64	160.06
	3 mI	16.8	12.4	1.35						5.9	8	7.4	3		1.6	2.1	2	2.1		3.84	17.69	73.56	21.53	
UP 2/5	mI	14.5	15.4	0.94	68.2	4.9	6.9	2.96	3.4	3.7	6.7	9.5	5.9	1.4	1.8	2.1	2.5	1.8	65.52	14.57	12.96	35.72	27.53	128.77
	mIII	13	18.5	0.70	68.2	4.1	9	3.17	3.5	4.4	5.3	9.2	6.1	1.3	2.2	2.2	2.7	2.1	34.5	21.95	16.21	48.06	38.16	120.72
UP 3/CT 2	mII	14.1	14.1	1.00	49.7	5.5		2.56	5.3	5.8	6.7	9.5		1.4	1.7	2.2	2.1		47.87	33.26	31.35		64.61	
	mIV	12.2	15	0.81	70.58	5.4	5.8	2.26	3.7	5.3	5.9	8.6	5.3	2	2.3	2.6	1.9	2.2	29.94	30.86	29.74	53.46	60.6	144
UP 4	mI	14.7	15.8	0.93	54.26	7.2	8.4	2.04	4	3	6.4	8	4.6	3.8	1.9	2.5	1.4	2.9	69.68	25.31	17.95	51.22	43.26	164.16
	mII	13.8	11.3	1.22	82.67	6.4	7.1	2.16		3	6.3	7	3.5				1.2	1.9		-6.42	18.51	79.15	12.09	
	mIII	18.2	14	1.30	39.42	7.6	7	2.39	4.2		5.2	9.8	4.5	1.6		1.2	2.9	3.4			15.38	14.64		
MBG 8834	mI	20.6	10.9	1.89	72.9	7.7	8.2	2.68	4.6	8.8	13.3	14.2	5.5	2.4	1.3	2.5		2.9	38.66	8.97	14.08	20.89	23.05	82.6
	mIII	19.1	12.3	1.55	49.9	5.1		3.75	6.8	9.6	12.6	14.2		2.5	1.7	2.2			30.68	18.98	12.32		31.3	
	mIV	17.1	15.2	1.13	60.46	4.2	9.4	4.07		3.9	9	11.8	6.7		1.9	1.4	1.3	1.4		27.9	14.19	15.15	42.09	
	mV	19.1	17	1.12	67.68	5.3	7.1	3.60	5.6	8.9	12.2	15.2	5	1.7	1.5	2.6	2.3	3.4	28.85	15.31	19.23	23.19	34.54	86.58
	mVI	20.2	16.2	1.25	61.31	5.1	8.1	3.96	3.4	5.8	10	14	7.8	1.7	2.2	2.2	2.8	2	40.12	27.66	17.93	10.47	45.59	96.18
	mVII	18.3	13.5	1.36	46.32	8.4		2.18	5.5	8.8	10.2	10.3		2.9	2.8	2.5			27.31	14.81	14.8		29.61	
MBG 10118/10132	mIII	7.8	10	0.78	63.43				2.9	4.7	4.6			2.2	1.5	1.7			39.94	0	67.14		67.14	
	mV	9	7.3	1.23	68.44				3	6.1	6.1			2	1.9	1.7			40.38	6.46				
	mX	7.5	6.3	1.19					2.8	5.1	5.2			1.3	1.4	1.5			26.22	4.37				
MBG 12465	2mI	11	8	1.38	55.04	4.7	3.4	2.34	4	3	3.2	4.8		0.8	0.9	1	0.9		39.67	93.81	18.69		112.5	
MBS 255	m	35.7	32.5	1.10	69.59	10.2	13.7	3.50	12.1	9.2	16.4	22.5	9.8	3.6	2.9	2.9	5.2	3.7	72.43	48.38	19.01	29.42	67.39	169.24
MBS 264	mI	15.8	16.2	0.98	66.6	3.8	7.3	4.16	5.6	6.3	9.8	12.2	4	1.2	1.2	2.5	2.4	1.3	57.7	22.48	13.29	30.16	35.77	123.63
	mII	16.3	15.7	1.04	74.05	4.9	7.8	3.33	5.2	8.8	10.4	9.2	5.8	1.5	1.8	2.3	2.6	1.9	-9.73	16.74	57.26	49.28	74	113.55
NS 43-104	mI	8.9	12.5	0.71	74.54	2.7	5.2	3.30	3.9	6.5	6.1	4.5	3.1	1.4	1.3	1.4	1.7	1.6	35.72	5.73	12.89	74.62	18.62	128.96
	mII	11.3	13.7	0.82	73.48	4	6.6	2.83	2.5	4.9	7.5	6.4	2.2	1.3	1.9	2.3	1.8	1.4	49.2	27.93	11.05	62.15	38.98	150.33
	mV	12.9	15.7	0.82	84.38	4.4	6.4	2.93	2.8	2.8	6.3	7.7	3.5	1.6	1.4	1.4	2.3	2.7	47.32	15.23	59.09	52.49	74.32	174.13

ML2 8	mI	9	9.9	0.91		2.9	6.2	3.10	2.6	5.4	6.1	6	3	1.2	1	1	1.2	1.1	17.64	18.43	0	33.24	18.43	69.31
	mII	7.2	10.6	0.68	74.19				2.7	4.3	5.2	5.4		0.9	1.1	1.1	1		28.98	12.35	23.38	40.82	35.73	105.53
av		**14.9**	**14.2**	**1.07**	**65.54**	**5.7**	**7.4**	**2.88**	**4.2**	**5.4**	**7.6**	**9.7**	**4.6**	**2**	**1.7**	**1.9**	**2.1**	**2.1**	**39.56**	**20.31**	**20.61**	**44.27**	**41.9**	**124.1**
min		**7.2**	**6.3**	**0.68**	**39.42**	**2.3**	**3.4**	**2.04**	**1.9**	**2.8**	**3.2**	**4.5**	**2.2**	**0.8**	**0.9**	**1**	**0.9**	**1.1**	**-9.73**	**-6.42**	**0**	**10.47**	**9.83**	**69.31**
max		**35.7**	**34.8**	**1.89**	**87.98**	**10.2**	**13.7**	**4.35**	**12.1**	**9.6**	**16.4**	**22.5**	**9.8**	**3.8**	**2.9**	**4.9**	**5.2**	**3.7**	**77.58**	**93.81**	**67.14**	**92.11**	**112.5**	**182.89**

Measures relative to the trackways

Sp	TR	SLp	PL lrp	PL rlp	PAp	LPp	WPp	WIp	WEp	DIVp	SLm	PL lrm	PL rlm	PAm	LPm	WPm	WIm	WEm	DIVm	Dmp	SL/FL	LE	BL	SL/BL
SV 13-28	1	77.1		51.3	98.36	39.5	32.5	17.8	48.9	-10.73	72.3		52.1	100.33	41.7	31.1	19.4	41.3	-6.37	16	4.82	2.54	53.7	1.44
		75.5	50.9		96.79	37.7	34.3	18.1	50.4	-26.01	72.6	41.6		103.82	30.5	28.3	18.1	41.7	11.31	18.3	4.72	1.86	50.6	1.49
		76		50.4	97.6	38.1	33	17.4	49	-6.58	78.8		50.4	108.12	42	27.8	16.8	40.1	-3.73	12.1	4.75	3.31	50.5	1.50
			50.8			37.8	33.5	17.7	51	-26.1		46.7			36.6	29	17.6	37.9	5.95	15		2.48		
		77.4								-12.04	78.6								9.1	14	4.84			
		82.2		50.3	107.58	41.3	28.6	18.1	36.8		81								24.49	14.8	5.14	1.40		
		78.4	51.4		102.96	40.7	31.7	18.1	43.3	-18.24											4.90			
				48.6		37.6	30.7	17.4	44.1				47.2		40.6	26.2	17.2	42.7	15.54	14		2.79		
										-27.91									1.76	15.3				
UP 1	1											55.6			45.2	32	19.6	48.8	7.5					
		105.6								-5.3	90.9								9.73	34.8	4.49			
		116.1		74.1	117.14	66.2	32.5	15.7	51.6	-4.35	115.3		69.4	127.88	63.7	27.6	16.1	43.3	7.35	20.1	4.94	3.23	80.3	1.45
		114.4	61.9		112.08	49.8	37.1	20.7	54.8	6.93	110.2	58.8		125.89	51.6	28.1	17.9	42.2	19.54	18.7	4.87	2.71	76.2	1.50
				75.8		65	38.8	23.9	57.1	0			64.7		58.4	27.8	18.2	41.9	4.99	19.4		3.18		
																				16				

	2	69.4		57.9	71.82	27.9	50.6	32.3	68.5	0	70.9		53.5	73.92	25.7	46.6	31.1	65.3	18.66	15.4	4.26	1.74	47	1.48
		56.2	60.4		61.67	41.1	44.3	27.7	56.1	-19.72		63.3			44.8	44.5	31.8	58.7		12.8	3.45	3.36		
				47		15.4	44.3	28.4	60.1	-8.45										16.6		0.46		
	3	103.8								-2.71	101.3								17.78	19.6	5.41			
										8.13									29.09	16.8				
UP 2/5		80.5	44.2		104.77	31	31.5	17.9	39.1	-7.96	81.8	48.5		112.42	36.7	31.8	20.8	41.8	3.98	16.4	4.47	2.06	51.6	1.56
				57		49.4	28.3	13.5	35.9				49.8		44.4	22.5	10.7	33.9		22		2.13		
										23.99									27.9	17.1				
UP 3/CT 2	3	41.5		47.8	42.95	-2.5	47.8	34.2	68.8		56.1		50.7	47.4	-3.3	50.7	40.5	67.2	-12.89	8.5	1.84	-0.34	36.1	1.15
		63.5	61.3		68.02	44	42.5	22.9	65.4		68.3	76.3		62.75	59.4	47.6	30.9	63.5	-41.4	7.6	2.81	6.80	46.7	1.36
				51.5		19.3	47.6	29.1	71.1	-29.43			42.1		8.6	41.3	26.5	54.8		23.2		0.60		
										-36.35									-9.78	12.4				
UP 4		83.6	47.5		83.7	17.3	44.1	27.8	56	-7.5	84.2	39.8		122.73	31.5	23.6	12.3	40	0	17.3	3.97	1.41	58.9	1.42
				75.4		66	35.8	19.9	47.8				56.1		52.4	19.6	9.5	37	5.41	31.7		1.87		
										-21.8									-9.84	17.9				
MBG 8834		111.5		74.6	118.84	66.5	33.4	15.7	56.2	-4.56	107.2		72.5	111.39	63	35.6	18.6	53.5	3.77	30.2	3.93	2.14	86.5	1.29
		109.5	54.3		118.45	44.7	30.8	13.9	52.8		105.5	56.7		110.04	44	35.9	18.6	47.9		27.2	3.86	1.63	70.6	1.55
		109.6		72.7	116.37	64.5	32.7	14.4	55.4	3.13	106.7		71.5	112.19	61.5	36.6	22.7	49.8	5.87	25.7	3.86	2.45	88.9	1.23
		109.4	56		113.99	45.2	33.2	14.4	56.6	0	113.3	56.8		119.01	45.2	34	20.5	53.2	-8.17	23.1	3.85	1.96	68.8	1.59
		112.7		73.8	111.51	64.3	36.1	16.1	59.4	4.73	111.9		74.4	117.5	67.9	30.1	16.3	49.1	8	23.1	3.97	2.86	86.7	1.30
		107.5	62.6		112.01	48.1	39.5	18.3	61.3	-2.73		56.1			43.9	35.1	20.3	48.3	0	26.4	3.79	1.74		
				67.2		59.1	32.3	16.9	52.8	7.13									10.38	22.2		1.33		
										0														
MBG 10118/10132	1	101.7	54.2		125.67	49.3	22.5	15.6	31	0	102.3	47.3		128.93	43.5	18.5	13.2	26.6	-7.35	12.9	8.92	3.60	49.6	2.05
		108.1		60.1	123.9	52.3	30.3	22.9	38.8	25.46	117.4		65.7	128.57	58.1	30.5	21.3	37.6	21.37	7.1	9.48	7.77	94.3	1.15
		99.4	62		120.22	55.5	26.9	16.6	35.7	6.43	96.2	64.5		124.43	59.1	25.9	14.2	31.3	14.04	12.7	8.72	4.51	40	2.49
		82.5		52.7	107.22	43.7	29.3	18.3	37.6	4.16	77		43.6	113.13	37.1	23	12	26.8		16.4	7.24	2.46	67.6	1.22
		97.1	50.92		116.33	38.8	31.2	19	41.5	8.04	93.1	48.6		122.05	39.8	27.6	16.9	32.7	8.93	9.7	8.52	4.05	44.4	2.19
		91.3		63.9	110.41	58.3	26.9	16.1	33.7	7.37			57.8		53.2	22.5	14.9	27.9	8.26	10.8	8.01	5.16		

			46.5			32.9	33	25.7	35.1	-4.26									0	5.8		2.84		
		90.4								17.56											7.93			
		95.7								19.09											8.39			
			70.6			62.3	33.2	25.7	39.1	24.57									4.71					
										2.41										9.1				
MBG 12465	2	85.4	49.3		106.5	39.3	33.5	26.4	50.5		83	43.9		104.57	28.8	24	28.3	40.1	6.24	19.6	9.09	1.74	50	1.71
		88.5		57.2	111.69	46.2	31.8	22.5	45.2	-6.43	89.9		60.1	119.89	54.2	25.4	21.8	33.2		10	9.41	5.02	60.6	1.46
			48.8			41.1	28.6	20.2	40	-9.96		43.6			35.6	33	16.8	32.7	48.01	16.7		2.30		
										11.89									14.53	11.7				
		97.1	51.9		112.35	40	34.4	29.5	47.8	0	94.6	51		123.97	40.5	28.3	22.9	37.4	8.92	12.2	10.33	3.30	50.6	1.92
		97		65.3	110.14	57.1	32.7	21.7	43.9	-2.39	90.8		55.6	118.33	54.2	21.8	14.2	29.1	0	13.3	10.32	4.18	55.9	1.74
			52.3			38.4	37.9	29.5	47.4	10.81		49.7			36.6	33.4	28.3	36.1	29.58	11.3		3.32		
		92									92.5								12.23	8.4	9.79			
										7.13									7.13	10.2				
MBS 10978										-6.48		44.6			38.4	22.9	12	34.4		18.5		1.04		
		70.8								11.2											4.66			
										13.16														
NS 43-104		53.1		45.2	79.8	38.3	23.7	12.2	31.9	-5.53	66.8		44.9	106.49	41.5	17.4	5.6	31.8	1.64	11.6	3.40	3.44	51.3	1.04
		38.1	36.8		59.78	13.7	34.2	22.4	46.6			38.7			24.2	29.8	19	41.1	3.62	14.7	2.44	1.29		
		50		38.7	83.07	24	30.3	18.6	41	-13.19	53								-4.33	25.2	3.21	0.48		
			36.3			25.5	25.6	14.7	37.3	10.87									55.63					
																				26.4				
ML2 8			28.1			17.2	22.4	14.5	35.1	1.54		30.8			19.9	23.5	14.6	34.5	14.93	14.6		1.27		
										-8.64									11.62	17.7				
av		**87.2**	**51.7**	**59.1**	**100.74**	**41.9**	**33.8**	**20.4**	**48**	**-1.81**	**89.1**	**50.6**	**57**	**109.83**	**42.5**	**30.02**	**19.2**	**41.9**	**8.15**	**16.8**	**5.71**	**2.62**	**60.7**	**1.53**
min		**38.1**	**28.1**	**38.7**	**42.95**	**-2.5**	**22.4**	**12.2**	**31**	**-36.35**	**53**	**30.8**	**42.1**	**47.4**	**-3.3**	**17.4**	**5.6**	**26.6**	**-41.4**	**5.8**	**1.84**	**-0.34**	**36.1**	**1.04**
max		**116.1**	**70.6**	**75.8**	**125.67**	**66.5**	**50.6**	**34.2**	**71.1**	**25.46**	**117.4**	**76.3**	**74.4**	**128.93**	**67.9**	**50.7**	**40.5**	**67.2**	**55.63**	**34.8**	**10.33**	**7.77**	**94.3**	**2.49**