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The Triassic–Jurassic boundary in Asturias (northern Spain): Palynological characterisation and facies

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Abstract

A palynological, biostratigraphic, sedimentological and sequence stratigraphy study of the Triassic–Jurassic transition in Asturias (northern Spain) was performed by logging and sampling the cores of two boreholes, the Cantavieyo and Vilorteo boreholes.

Four lithological units were differentiated and correlated. The lower unit, composed of mudstones and evaporites deposited in coastal lake to subaerial sabkha and distal alluvial environments, correlated in part with the Upper Triassic Keuper facies present in most of western Europe. The middle unit of well bedded carbonates corresponds to the Solis Member of the Gijón Formation. This unit was deposited on a shallow, subtidal to inter- and supratidal carbonate platform influenced by storms and with interbedded distal fan-delta facies. The Triassic–Jurassic boundary has been located within the carbonates of the Solis Member, which contain a Hettangian ammonite, *Caloceras pirondii* (Reynés), in tempestitic carbonates attributed to the upper part of this unit. The upper unit, the Barzana Member, is composed of mudstones, evaporites and carbonates, respectively, deposited in distal alluvial environments, in supratidal sabkha environments, and on a shallow subtidal to intertidal platform. Overlying the upper unit, or as a time equivalent of the Barzana Member, the Fabares Member is composed of a carbonate breccia with a lutitic matrix, interpreted as formed by the dissolution of the evaporites of the Barzana Member and the collapse of the originally interbedded carbonates and mudstones.

A total of 49 palynomorph taxa have been recorded: 20 spore taxa, 24 pollen taxa, 1 acritarch, 2 prasinophytes, and 2 dinoflagellate cysts. Three palynological assemblages (PA) have been distinguished. PA1, which is typically Rhaetian, corresponds to the *Rhaetipollis germanicus* Zone. PA2 can be Rhaetian and/or Hettangian in age. PA3, which is Hettangian in age, partly corresponds to the *Kraeuselisporites reissingeri* Zone. These zones have been correlated with similar zones in northwestern Europe.

Palaeoecological analysis of the palynomorph assemblages indicates marked palaeofloral renewal, from diversified, Late Triassic xerophilous plants to an impoverished palaeofloral community at the Triassic–Jurassic transition. The latter was composed of a poorly diversified group of conifers and ferns. The arid climate of the Late Triassic was followed by a short, humid event at the beginning of the Hettangian, during which the renewal and important recovery of vascular cryptogams and conifers occurred. The later predominance of xerophilous species in the Hettangian indicates a recovery of arid climatic conditions.

After the turnover at the end of the Triassic, and especially during the Hettangian, the recovery of new species is well marked. Of a total of 21 palynomorphs, 7 species did not surpass the base of the Triassic–Jurassic transition, 6 species appeared in this transition, and 22 species appeared in the Hettangian, marking an outstanding phase of recovery for the plants that generated the studied palynomorphs.

Keywords: Triassic–Jurassic; biostratigraphy; palynology; climate change

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Publications A. Baud 2006

Baud, A., Richoz, S., and Pruss, S., 2006, The lower Triassic anachronistic carbonate facies in space and time: Global and Planetary Change, v. In Press, Corrected Proof.

Pruss, S. B., Bottjer, D. J., Corsetti, F. A., and Baud, A., 2006, A global marine sedimentary response to the end-Permian mass extinction: Examples from southern Turkey and the western United States: *Earth-Science Reviews*, v. 78, no. 3-4, p. 193-206.

Yin, H., Feng, Q., Lai, X., Baud, A., and Tong, J., 2006, The protracted Permo-Triassic crisis and multi-episode extinction around the Permian-Triassic boundary: Global and Planetary Change, v. In Press, Corrected Proof.

.....

Publications G. Cassinis 2005 et 2006

- **Cassinis G. and Santi G. (2005)** - Permian tetrapod footprint assemblages from southern Europe and their stratigraphic implications. In: Lucas S.G. and Zeigler K.E., eds., The Nonmarine Permian, New Mexico Museum of Natural History and Science Bulletin No. 30, 26 – 38, Albuquerque.
 - **Virgili C., Cassinis G. and Broutin J. (2006)** – Permian to Triassic sequences from selected continental areas of southwestern Europe. In: Lucas S.G., Cassinis G. and Schneider J.W., eds., Non-Marine Permian Biostratigraphy and Biochronology, Geological Society London, Special Publications, 265, 231-259.
 - **Cassinis G., Cortesogno L., Gaggero L., Perotti C. and Ronchi A. (2006)** – Volcanic products from the Early Permian Collio Basin (Southern Alps) and their geodynamic implications. *Periodico di Mineralogia*, Roma. In press.
 - **Cassinis G., Durand M. and Ronchi A. (2006)** – Remarks on the Permian-Triassic transition in central and eastern Lombardy (Southern Alps, Italy). *Journal of Iberian Geology*, Madrid. In press.
 - **Cassinis G. and Perotti C.R. (2006)** – Stratigraphical and paleogeographical outline of post-Variscan Verrucano-like deposits from Italian areas, and their regional geodynamic implications. In: Intern. Conf. on “Stratigraphy and Palaeogeography of Late- and Post-Hercynian Basins in the Southern Alps, Tuscany and Sardinia (Italy). Comparisons with other Western Mediterranean Areas and Geodynamic Hypotheses”, 18-23 September, 2006, Siena, Italy, Abstracts, 7-8. *Bollettino della Società Geologica Italiana, Volume Speciale*. Roma. In progress.
 - **Perotti C.R. and Cassinis G. (2006)** – Late Variscan geodynamic setting of the continental basins in Southern Europe. In: Intern. Conf. on “Stratigraphy and Palaeogeography of Late- and Post-Hercynian Basins in the Southern Alps, Tuscany and Sardinia (Italy). Comparisons with other Western Mediterranean Areas and Geodynamic Hypotheses”, 18-23 September, 2006, Siena, Italy, Abstracts, 9-10. *Bollettino della Società Geologica Italiana, Volume Speciale*. Roma. In progress.
 - **Ronchi A., Pittau P., Cassinis G., Del Rio M. and Durand M. (2006)** – The Val Daone Conglomerate: a Middle Permian unit in the central Southern Alps (Trentino, Italy). Preliminary data. In: Intern. Conf. on “Stratigraphy and Palaeogeography of Late- and Post-Hercynian Basins in the Southern Alps, Tuscany and Sardinia (Italy). Comparisons with other Western Mediterranean Areas and Geodynamic Hypotheses”, 18-23 September, 2006, Siena, Italy, Abstracts, 9-10. *Bollettino della Società Geologica Italiana, Volume Speciale*. Roma. In progress.
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Geological Society of America. 2006. *Geology*; May 2006; v. 34; no. 5; p. 385–388; doi: 10.1130/G22176.1; 2 figures. 385

A Martian analog in Kansas: Comparing Martian strata with Permian acid saline lake deposits By Kathleen C. Benison*

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ABSTRACT

An important result of the Mars Exploration Rover’s (MER) mission has been the images of sedimentary structures and diagenetic features in the Burns Formation at Meridiani Planum. Bedding, cross-bedding, ripple marks, mud cracks, displacive evaporite crystal molds, and hematite concretions are contained in these Martian strata. Together, these features are evidence of past saline groundwater and ephemeral shallow surface waters on Mars. Geochemical analyses of these Martian outcrops have established the presence of sulfates, iron oxides, and jarosite, which strongly suggests that these waters were also acidic. The same assemblage of sedimentary structures and diagenetic features is found in the salt-bearing terrestrial red sandstones and shales of the middle Permian (ca. 270 Ma) Nippewalla Group of Kansas, which were deposited in and around acid saline ephemeral lakes. These striking sedimentological and mineralogical similarities make these Permian red beds and evaporites the best-known terrestrial analog for the Martian sedimentary rocks at Meridiani Planum.

Keywords: Mars, red beds, evaporites, acidity.

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BIBLIOGRAPHIE TRANSMISE PAR B. BONIN

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<http://springerlink.metapress.com>:

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Journal of African Earth Sciences, ISSN : 1464-343X, Volume : 43, Issue : 5, Date : Dec-2005

"Autunian age constrained by fold tests for paleomagnetic data from the Mezarif and Abadla basins (Algeria)", N. Merabet, B. Henry, A. Kherroubi, S. Maouche, pp 556-566 Full text via ScienceDirect :
http://www.sciencedirect.com/science?_ob=GatewayURL&_origin=CONTENTS&_method=citationSearch&_piikey=S1464343X05001500&_version=1&md5=1977d5ba115eac86281d2407ed8eea5e

Palaeogeography, Palaeoclimatology, Palaeoecology, ISSN : 0031-0182, Volume : 230, Issue : 1-2, Date : 17-Jan-2006

"Record of palaeoenvironmental changes in a Lower Permian organic-rich lacustrine succession: Integrated sedimentological and geochemical study of the Rudnik member, Krkonose Piedmont Basin, Czech Republic", K. Martinek, M. Blecha, V. Danek, J. Francu, J. Hladikova, R. Johnova, D. Ulicny, pp 85-128 Full text via ScienceDirect :
http://www.sciencedirect.com/science?_ob=GatewayURL&_origin=CONTENTS&_method=citationSearch&_piikey=S003101820500413X&_version=1&md5=b8d004b9c58aae5c2197c0296dce917c

.....

Béthoux, O. (2006). Revision of *Cacurgus Handlirsch, 1911*, a basal Pennsylvanian Archaeorthoptera (Insecta: Neoptera). *Bulletin of the Peabody Museum of Natural History*, 47, 29-35.

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Lower Triassic sequence stratigraphy of the western part of the Germanic Basin (west of Black Forest): Fluvial system evolution through time and space

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Abstract

The aim of this paper is to analyse the fluvial evolution of the Lower Triassic in the western part of the Germanic Basin through time and space, as well as the impact of the geodynamic and climatic setting on the preservation of fluvial deposits. The Lower Triassic crops out only in the Vosges Massif and the Black Forest, so well-log studies are required to realise sequence stratigraphy correlations and establish comparisons with others parts of the Germanic Basin. In a first step, we use well-log data analyses to characterise the electrofacies associations in the Triassic and then define the well-log signatures of each formation. In a second step, the characterisation and recognition of genetic sequences and their stacking pattern allow us to define seven minor cycles integrated into two major cycles. Finally, the quantification of the lithologies at different stages of basin evolution leads to the reconstruction of paleoenvironmental maps to illustrate facies evolution through space and time. A comparison with cycles defined in the Germanic Basin allows us to propose correlations of the Lower Triassic on either side of the Rhine Graben and leads to a discussion of the evolution of fluvial systems through time and space.

During the Scythian, the fluvial style is characterised by braided fluvial systems evolving laterally into lake deposits towards the central part of the Germanic Basin. During this stage, the basin was a huge depression with very few marine connections in its extreme eastern part. The stratigraphic cycles represent rhythmic fluctuations in relative lake level that could be attributed to sediment supply and/or lake level variations in an arid setting. Four minor stratigraphic cycles are observed that are integrated within a single major stratigraphic cycle. During the period of the stratigraphic base-level rise of the major cycle, a maximum of 233 m of sediment would represent a duration of sedimentation in the Paris Basin of at least 1.8 m.y. During the period of the stratigraphic base-level fall of the major cycle, a maximum of 65 m of sediment would have accumulated over 2.5 m.y. On the western edge of the Germanic Basin, the top of the Scythian is marked by a major sedimentary break characterised by a planation surface, with preservation of the first paleosols, followed by the Hardegsen unconformity. This unconformity is tectonically deformed, leading to the development of a new sedimentation area in the west of the basin. The fluvial sedimentation above this discontinuity shows a trend towards enhanced development of floodplain or lacustrine-type environments at its western margin, with the formation of paleosols. The fluvial systems are linked with sabkhas, and then with a shallow sea connected to the Tethys Ocean. In this context, the stratigraphic cycles are caused by variations in relative sea level and/or sediment supply. The fluvial deposits are preserved in an exoreic basin.

Keywords: Lower Triassic; Fluvial sedimentation; Sequence stratigraphy; Well-log analysis; Paris and Germanic basins; Paleoenvironmental maps

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The Early Triassic ammonoid recovery: Paleoclimatic significance of diversity gradients

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Abstract

Ammonoids recovered much faster than other marine shelly invertebrates after the end-Permian mass extinction. Based on a refined global data set at the basin level, we investigate the paleobiogeographical global latitudinal and longitudinal diversity patterns in terms of climatic changes during the Early Triassic. Such analysis differs from already published qualitative or quantitative studies in that it estimates faunal patterns and endemism at an ecologically meaningful level of spatial resolution,

i.e. at the basin level. During the Early Triassic, the global first order trend in increasing ammonoid diversity was accompanied by a progressive change from cosmopolitan to latitudinally-restricted distributions. This led to the emergence of a clear latitudinal diversity gradient during most of the Smithian and Spathian stages, which entails increased steepness of the Sea Surface Temperature gradient during the late Early Triassic. However, two brief episodes of ammonoid cosmopolitanism combined with low global diversity interrupted the first order increasing trend at the very beginning of the Smithian and at its very end. The longitudinal analysis of Smithian distributions indicates a westward decrease of diversity within the Tethys, which faded away during the Spathian. Analysis of endemism indicates a rapid biogeographical maturing and structuring of faunas concomitant with the edification of the latitudinal diversity gradient.

Keywords: Early Triassic; Ammonoids; Paleobiogeography; Generic richness; Sea surface temperature

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Reconstitution d'un « paysage de l'époque houillère » revue à la lumière des découvertes récentes sur les cuticules végétales fossiles

Reconstruction of a Late Carboniferous landscape high lighted by new discoveries on fossil vegetal cuticles

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Résumé

Aujourd'hui, les plantes à port grimpant ou rampant sont largement représentées, par nombre d'espèces différentes dans les écosystèmes à climat chaud et humide des forêts équatoriales. Bien que l'on ait, depuis longtemps, supposé que certaines Ptéridospermaphytes aient pu développer, dès le Carbonifère supérieur, le même type de stratégie de croissance que les lianes ou les plantes volubiles actuelles, seul un petit nombre d'exemples avait été étayé sur des bases hypothétiques plus ou moins convaincantes. Aussi la plupart des « morpho-genres » de « fougères à graines » du paléozoïque supérieur sont-ils encore le plus souvent reconstitués « automatiquement » comme des formes arborescentes érigées, autoportantes sur la base de l'extrapolation à l'ensemble du groupe de données morphologiques et anatomiques générales définies sur les quelques formes les mieux connues. Cependant, ces dernières années, des avancées considérables ont été faites dans la reconstitution du mode de croissance des plantes fossiles grâce à l'analyse de leurs cuticules. Ainsi, par exemple, la mise en évidence d'organes spécialisés impliquant un port grimpant et/ou volubile sur des cuticules de Ptéridospermaphytes collectées dans le bassin stéphanien de Blanzay-Montceau (Massif Central, France), a révolutionné la vision « stéréotypée » que l'on avait de beaucoup de ces plantes. Ce type de découverte démontre les potentialités de l'analyse cuticulaire pour la reconstitution du mode de croissance et de l'architecture des plantes fossiles. La mise en évidence de la proportion beaucoup plus élevée de ce type de formes biologiques de Ptéridospermes, au sein des communautés végétales peuplant les marécages houillers (insoupçonnée jusqu'à la dernière décennie) doit donc maintenant être prise en compte dans les reconstitutions du « paysage houiller ».

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Pérez Huerta, Alberto: Pennsylvanian Brachiopods of the Great Basin (USA). 2006. p.~97-169, 16~pl., 5~fig.

keywords: Brachiopods; Pennsylvanian; Great Basin;

Chen, Z.Q. & Shi, G.R.: Artinskian-Kungurian (Early Permian) brachiopod faunas from the Tarim Basin, Northwest China. Part 2: Paleobiogeography, and systematics of Orthotetida, Orthida, Spiriferida, Spiriferinida, Rhynchonellida, Athyridida and Terebratulida. 2006. p.~1-53, 12~pl., 32~fig., 3~tab.

keywords: Artinskian; Kungurian; brachiopod faunas; biogeography;

Waterhouse, J. Bruce & Chen, Zhong-Qiang: Stratigraphy and Mollusca of the Late Permian Senja Formation, Manang area, Nepal Himalaya. 2006. p.~55-96, 2~pl., 12~fig., 9~tab.

keywords: Mollusca; Nepal; Himalaya; Oberperm;

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Chen, Z.Q. & Shi, G.R.: Artinskian-Kungurian (Early Permian) brachiopod faunas from the Tarim Basin, Northwest China. Part 1: Biostratigraphy and systematics of Productida. 2006. p.~113-177, 15~pl., 15~fig., 9~tab., 1~fold-out

Palaeontographica Abt. A Vol. 273

Campi, Monica J., Shi, G.R. & Leman, Mohd Shafeea: Guadalupian (Middle Permian) brachiopods from Sungai Toh, a Leptodus Shale locality in the Central Belt of Peninsular Malaysia. Part I: Lower Horizons. 2005. p.~97-160, 8~pl., 9~fig., 1~tab.

keywords: Palaeosinopa; Buxolestes; Pantolestidae; Fossil Butte; Green River Formation; Lower Eocene; semiaquatic life style; postcranial skeleton;

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Chen, Z. Q.: Lower Permian reef-dwelling brachiopod faunas from the Tarim Basin, Northwest China: biostratigraphy, palaeoecology and biogeography. 2004. p.~1-96, 12~pl., 20~fig., 5~tab.

keywords: reef-dwelling brachiopods; palaeoecology; biogeographical affinity; Lower Permian; China;

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THE VERTEBRATE FAUNA OF THE UPPER PERMIAN OF NIGER. V. THE PRIMITIVE TEMNOSPONDYL SAHARASTEGA MORADIENSIS

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ABSTRACT—The skull of the temnospondyl amphibian *Saharastega moradiensis*, from the Upper Permian Moradi Formation (Izégouandane Group, Izégouandane Basin) of northwestern Niger, is described in detail. *Saharastega moradiensis* is the most primitive known temnospondyl from Gondwana and possesses a combination of plesiomorphic and apomorphic character states, which suggest affinities with the Edopoidea, a clade of basal temnospondyls from the Upper Carboniferous and Lower Permian of Euramerica. These include the exclusion of the lacrimal from the orbital margin, the exclusion of the vomers and palatines from the interpterygoid vacuities, and the presence of an intertemporal ossification. Autapomorphies of the new taxon include the presence of narrow and elongated, transversely oriented nostrils; an extensive tongue-and-groove contact between the premaxillae and maxillae; tabulars that possess exceptionally large, laterally and ventrally directed ‘horns’; and an extraordinary ‘occipital plate’ that may be formed, at least in part, by a supraoccipital ossification. A phylogenetic analysis of select Paleozoic temnospondyls indicates that *S. moradiensis* is the sister taxon to the edopoids, represented in this analysis by *Chenoprosopus* and *Edops*. This suggests that *S. moradiensis* represents a late-surviving member of a clade that is the sister group of the Edopoidea. Members of this clade may have been restricted to equatorial northwest Africa during the Late Carboniferous and Early Permian, an area that was not affected by the extensive glaciation that covered much of southern Pangea.

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The problem of the transition from the Permian to the Triassic Series in southeastern France: comparison with other Peritethyan regions

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Abstract: In the French sedimentary basins, widespread alluvial deposits sealing narrow Permian troughs are referred to as ‘Buntsandstein’. An Early Triassic age is generally put forward despite a lack of any Scythian biochronological elements. In Provence (Southeast Basin) some doubts remain about the age of the latest Permian deposits, and the oldest Triassic fossils (Anisian palynomorphs) appear in the upper ‘Buntsandstein’. Three types

of contact occur: disconformity overlain by a quartz-conglomerate, apparent transition, and angular unconformity, according to an increasing basal incompleteness of the 'Buntsandstein'. Whereas the conglomerate was deposited under arid conditions, the overlying fluvial deposits indicate a marked climate change. A transect from France up to the Germanic Basin centre shows that the 'French Buntsandstein' cycle might begin considerably before the end of the Permian; the Early Triassic arid 'event' is Dienerian/Smithian in age; and the Provençal 'basal' conglomerate corresponds to the uppermost part of a coeval subordinate cycle, and thus the underlying sub-Triassic unconformity represents a hiatus estimated at 10–15 Ma. Works in progress confirm that sedimentary climate indicators constitute powerful tools for correlations within non-marine formations devoid of biostratigraphical marker that straddle the Permian–Triassic boundary, at least on the scale of the Western European Plate. In the three main French sedimentary basins (the Paris, Southeast and Aquitaine basins) the Mesozoic cycle begins, at least in some parts,

with widespread alluvial deposits burying relatively narrow Permian troughs, and frequently referred to as the 'Buntsandstein' Group. The basal beds of this 'Buntsandstein' were dated in one place only: above the small Lodève Permian basin, where they yielded a Mid- Anisian palynoflora (Broutin *et al.* 1992). In all other areas where the Middle Triassic was recognized – in the upper part of the 'Buntsandstein' or higher – an Early Triassic age is generally accepted for these red sandy and gravelly units despite the fact that, up to now, no Scythian biochronological indicators have been found. Thus, in actual fact the position of the Permian–Triassic Boundary

(PTB) with respect to the sub-'Buntsandstein' unconformity is not straightforward. For regions stretching further southwest 'North Iberian domain', including the Balearic Islands: Broutin *et al.* 1992) a Late Permian age is

adopted for that unconformity, the lower 'Buntsandstein' still yielding 'Thuringian' (*sensu* Visscher 1971) palynofloras. A similar context prevails in the very NE corner of France (Dachroth 1985; Durand *et al.* 1994). Where the non-marine sedimentation seems to have been continuous from the Permian to the Triassic, the PTB is readily believed to coincide with an abrupt change in fluvial style, sometimes related to the global-scale end-Permian extinction (Ward *et al.* 2000). In other regions, it is generally admitted that the sub-'Buntsandstein' unconformity

actually fits with the boundary between the Permian and Triassic series. Nevertheless, in both cases the lack of typically Early Triassic fossil remains can be explained either by conditions unfavourable to life and preservation (i.e. 'desert' environments) or by a true stratigraphical gap. The purpose of this paper is for the first time to test these alternatives on case studies in Provence, where the largest outcrop area of Permian–Triassic deposits in the French Southeast Basin is present (Fig. 1), by using sedimentological climate indicators and step-by-step geometric correlations towards sections that have increasing completeness. These results will be used to tentatively propose a more or less new correlation scheme for other European regions.

The PTB problem in Provence

On the regional scale there is no difficulty distinguishing the 'Buntsandstein' Group (Fig. 1). Constituting the base of the Mesozoic section, it crops out along a narrow, practically continuous belt from Sanary (SW) to Cannes (NE). It reflects a clear change from local drainage systems in several distinct basins, a characteristic of the Permian palaeogeography, to a single widespread system that is typical of the Triassic,

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Calcareous algae from the Triassic (Anisian reef boulders and Norian reef limestones) of Karaburun, western Turkey
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Abstract

Invertebrate Anisian and Norian reef boulders were found in the Gerence and Güvercinlik Formations, respectively, exposed in northeastern part of the Karaburun Peninsula, western Turkey. Halimedacean green algae and solenoporacean red algae, usually associated with other reef building organisms are described in this paper. The following taxa were determined: halimedaceans: *Egericodium hungaricum* Flügel, Velledits, Senowbari-Daryan and Riedel, *Aternasus irregularis* n. gen., n. sp.; solenoporaceans: *Solenopora* cf. *alcicornis* Ott, *Solenopora triasina* Vinassa de Regny, *Solenopora vachardi* n. sp., *Solenopora concentrica* n. sp., *Solenopora paraconcentrica* n. sp., *Tauristorea parallela* Senowbari-Daryan and Link, *Tauristorea discursa* n. sp., and *Parachaetetes cassianus* (Flügel).

The monospecific genus *Aternasus* n. gen. is the most abundant alga within the Anisian reef boulders. The solenoporaceans are represented by several taxa but the individual species are less abundant. *E. hungaricum*, *T. parallela* Senowbari-Daryan and Link, and *S. triasina* Vinassa de Regny are described from the Norian reef limestones embedded in Güvercinlik Formation, all other taxa from the Anisian reef boulders embedded in the Gerence Formation.

Keywords Algae - Triassic - Anisian - Norian - Karaburun - Turkey

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 236, Issues 3-4 , 27 June 2006, Pages 272-289

Identification of the Guadalupian–Lopingian boundary in the Permian in a bedded chert sequence, South China

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Abstract

Middle–Upper Permian conodont biostratigraphy was examined in a bedded chert section in Dachongling area of southeastern Guangxi Zhuang Autonomous Region, South China. Four conodont zones were recognized, namely, *Jinogondolella granti* Zone, *Clarkina postbitteri hongshuiensis* Zone, *Clarkina postbitteri postbitteri* Zone, and *Clarkina dukouensis* Zone, in ascending order. The four conodont zones can be correlated with those recognized previously in bathyal carbonate and lime–chert sequences. On the basis of the correlation, we identified the Guadalupian–Lopingian (G–L) geochronostratigraphic boundary (i.e. the basal boundary of Lopingian Series) in the Permian. Six radiolarian zones were also recognized in the same section, namely, *Pseudoalbaillella longtanensis* Zone, *Pseudoalbaillella globosa* Zone, *Follicucullus monacanthus* Zone, *Follicucullus scholasticus* Zone, *Follicucullus charveti* Zone and *Albaillella levis* Zone, in ascending order. Correlations between radiolarian zones and conodont zones are shown here. The ecological evolutionary process of conodonts and radiolarians changed abruptly through the inferred G–L geochronostratigraphic boundary. Besides these, a geochemical anomalous zone with the higher Ce / Ce* values occurred underlying the G–L geochronostratigraphic boundary and petrological diagnoses around the G–L boundary changed. The abrupt change of ecological evolution in coincidence with the geochemical anomalous zone and change of petrological diagnoses might show the pre-Lopingian catastrophic event of marine faunas. The reason of the event of marine faunas may be that a regression occurred at the end of the Guadalupian.

Keywords: Conodont; Radiolaria; Bedded chert sequence; Guadalupian–Lopingian geochronostratigraphic boundary; Rare earth elements; Petrological diagnoses; South Chi

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Première caractérisation palynologique du Trias moyen dans le Haut Atlas ; implications pour l'initiation du rifting téthysien au Maroc

L'Anisien moyen est caractérisé palynologiquement pour la première fois, à l'échelle du Maroc tout entier, dans le Haut Atlas de Marrakech. Les implications stratigraphiques, tectoniques et paléogéographiques de cette découverte sont analysées. Pour

El Arabi, Diez, Broutin, Essamoud

Trias / Palynologie / Biostratigraphie / Corrélations / Tectonique / Paléogéographie

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Sedimentology Volume 53 Page 435 - April 2006 Volume 53 Issue 2

Cyclicality in the nearshore marine to coastal, Lower Permian, Pebbley Beach Formation, southern Sydney Basin, Australia: a record of relative sea-level fluctuations at the close of the Late Palaeozoic Gondwanan ice age

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Abstract

The Lower Permian (Artinskian to Sakmarian) Pebley Beach Formation (PBF) of the southernmost Sydney Basin in New South Wales, Australia, records sediment accumulation in shallow marine to coastal environments at the close of the Late Palaeozoic Gondwanan ice age. This paper presents a sequence stratigraphic re-evaluation of the upper half of the unit based on the integration of sedimentology and ichnology. Ten facies are recognized, separated into two facies associations. Facies Association A (seven facies) comprises variably bioturbated siltstones and sandstones with marine body fossils, interpreted as recording sediment accumulation in open marine environments ranging from lower offshore to middle shoreface water depths. Evidence of deltaic influence is seen in several Association A facies. Facies Association B (three facies) comprises mainly heterolithic, interlaminated and thinly interbedded sandstone and siltstone with some thicker intervals of dark grey, organic-rich mudstone, some units clearly filling incised channel forms. These facies are interpreted as the deposits of estuarine channels and basins. Throughout the upper half of the formation, erosion surfaces with several metres relief abruptly separate open marine facies of Association A (below) from estuarine facies of Association B (above). Vertical facies changes imply significant basinward shift of environment across these surfaces, and lowering of relative sea level in the order of 50 m. These surfaces can be traced over several kilometres along depositional strike, and are defined as sequence boundaries. On this basis, at least nine sequences have been recognized in the upper half of the formation, each of which is < 10 m thick, condensed, incomplete and top-truncated. Sequences contain little if any record of the lowstand systems tract, a more substantial transgressive systems tract and a highstand systems tract that is erosionally truncated (or in some cases, missing). This distinctive stacking pattern (which suggests a dominance of retrogradation and progradation over aggradation) and the implied relative sea-level drop across sequence boundaries of tens of metres are remarkably similar to some other studies of continental margin successions formed under the Neogene icehouse climatic regime. Accordingly, it is suggested that the stratigraphic architecture of the PBF was a result of an Icehouse climate regime characterized by repeated, high-amplitude cycles of relative sea-level change.

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Palaeogeography, Palaeoclimatology, Palaeoecology Article in Press, Corrected Proof -

Late Early Triassic climate change: Insights from carbonate carbon isotopes, sedimentary evolution and ammonoid paleobiogeography

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Abstract

The late Early Triassic sedimentary–facies evolution and carbonate carbon-isotope marine record ($\delta^{13}\text{C}_{\text{carb}}$) of ammonoid-rich, outer platform settings show striking similarities between the South China Block (SCB) and the widely distant Northern Indian Margin (NIM). The studied sections are located within the Triassic Tethys Himalayan belt (Losar section, Himachal Pradesh, India) and the Nanpanjiang Basin in the South China Block (Jinya section, Guangxi Province), respectively. Carbon isotopes from the studied sections confirm the previously observed carbon cycle perturbations at a time of major paleoceanographic changes in the wake of the end-Permian biotic crisis. This study documents the coincidence between a sharp increase in the carbon isotope composition and the worldwide ammonoid evolutionary turnover (extinction followed by a radiation) occurring around the Smithian–Spathian boundary.

Based on recent modeling studies on ammonoid paleobiogeography and taxonomic diversity, we demonstrate that the late Early Triassic (Smithian and Spathian) was a time of a major climate change. More precisely, the end Smithian climate can be characterized by a warm and equable climate underlined by a flat, pole-to-equator, sea surface temperature (SST) gradient, while the steep Spathian SST gradient suggests latitudinally differentiated climatic conditions. Moreover, sedimentary evidence suggests a transition from a humid and hot climate during the Smithian to a dryer climate from the Spathian onwards. By analogy with comparable carbon isotope perturbations in the Late Devonian, Jurassic and Cretaceous we propose that high atmospheric CO₂ levels could have been responsible for the observed carbon cycle disturbance at the Smithian–Spathian boundary. We suggest that the end Smithian ammonoid extinction has been essentially caused by a warm and equable climate

related to an increased CO₂ flux possibly originating from a short eruptive event of the Siberian igneous province. This increase in atmospheric CO₂ concentrations could have additionally reduced the marine calcium carbonate oversaturation and weakened the calcification potential of marine organisms, including ammonoids, in late Smithian oceans.

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General Palaeontology (Palaeoecology)

Recovery of the Triassic land flora from the end-Permian life crisis

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Abstract

The recovery of the Triassic land flora after the end-Permian biotic crisis has not been studied in detail except in North China where examination of a complete sequence of Permian–Triassic strata containing fossil plants revealed that the recovery lasted until the end of the Middle Triassic. Our analysis of the Triassic floras of Europe shows that their recovery began, as in North China, with the proliferation of the lycopsid *Pleuromeia* during the Early Triassic and that it proceeded with the resurgence of the conifers in the early Middle Triassic (Early Anisian), the return of the cycadophytes and the pteridosperms in the Late Anisian and the progressive evolutionary modernization of the subsequent. This study shows that the climate played an essential role and that the temperature gradient from the equator to the poles was low. The fact that *Pleuromeia* was the most distinctive feature of the Early Triassic all over

Eurasia and in the southern continents suggests that this lycopsid was an opportunistic pioneer plant which took advantage of the post-crisis vacuity of the environment to proliferate, preparing sites for recolonization with the plants having survived in refugia.

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 237, Issues 2-4 , 4 August 2006, Pages 160-181

Carbon isotope excursions and microfacies changes in marine Permian–Triassic boundary sections in Hungary

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Abstract

Several Permian–Triassic boundary sections occur in various structural units within Hungary. These sections represent different facies zones of the western Palaeotethys margin. The Gárdony core in the NE part of the Transdanubian Range typically represents the inner ramp, while the Bálvány section in the Bükk Mountains of northern Hungary represents an outer ramp setting. The two sections have different patterns for their $\delta^{13}\text{C}$ values. The Bálvány section shows a continuous change towards more negative $\delta^{13}\text{C}$ values starting at the first biotic decline, followed by a sharp, quasi-symmetric negative peak at the second decline. The appearance of the $\delta^{13}\text{C}$ peak has no relationship to the lithology and occurs within a shale with low overall carbonate content, indicating that the peak is not related to diagenesis or other secondary influences. Instead, the shift and the peak reflect primary processes related to changes in environmental conditions. The continuous shift in $\delta^{13}\text{C}$ values is most probably related to a decrease in bioproductivity, whereas the sharp peak can be attributed to an addition of C strongly depleted in ^{13}C to the ocean–atmosphere system. The most plausible model is a massive release of methane-hydrate. The quasi-symmetric pattern suggests a rapid warming–cooling cycle or physical unroofing of sediments through slope-failure and releasing methane-hydrate. The Gárdony-1 core shows a continuous negative $\delta^{13}\text{C}$ shift starting below the P–T boundary. However, the detailed analyses revealed a sharp $\delta^{13}\text{C}$ peak in the boundary interval, just below the major biotic decline, although its magnitude doesn't reach that observed in the Bálvány section. Based on careful textural examination and high-resolution stable isotope microanalyses we suggest that the suppression of the $\delta^{13}\text{C}$ peak that is common in the oolitic boundary sections is due to combined effects of condensed sedimentation, sediment reworking and erosion, as well as perhaps diagenesis.

Keywords: Permian–Triassic boundary; Stable isotopes; Bükk Mountains; Transdanubian Range

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FIRST RECORD OF A HETERODONT BIVALVE (MOLLUSCA) FROM THE EARLY TRIASSIC: PALAEOECOLOGICAL SIGNIFICANCE AND IMPLICATIONS FOR THE 'LAZARUS PROBLEM'
by MICHAEL HAUTMANN* and ALEXANDER NÜTZEL†

Abstract: The heterodont bivalve *Sinbadiella pygmaea* gen. et sp. nov. is described from the Sinbad Limestone Member (Olenekian, Smithian) of the Lower Triassic Moenkopi Formation of Utah (USA). The new taxon is tentatively assigned to the Lucinidae on the grounds of its external morphology, larval shell morphology and hinge characters. It is the only definite representative of the Superorder Heterodonta in the Olenekian, removing this major clade of bivalves from the long list of Early Triassic Lazarus taxa. Although at least locally very abundant, the new taxon has been overlooked by earlier workers, probably due to its minute size. Dwarfism is a widespread phenomenon in Early Triassic faunas, which has been attributed to ongoing reduction of primary production. If *S. pygmaea* was a lucinid, a chemosymbiotic feeding mode can be inferred, which might explain why it was able to thrive in conditions that suppressed filter feeding

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Triassic–Jurassic boundary events: Problems, progress, possibilities

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Sedimentary Geology Volume 185, Issues 3-4 , 15 March 2006, Pages 239-253

Calciomicrobial stromatolites at the Permian–Triassic boundary in a western Tethyan section, Bükk Mountains, Hungary

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Abstract

Basal Triassic carbonates of the Gerennavár Formation (Bükk Mountains, Northern Hungary) were studied. The succession was deposited in an open marine deep ramp environment of the western Tethys, and can be divided into three parts on the basis of the dominant microfacies. The lowermost 0.5 m-thick interval is made up by thin-bedded and bioturbated mudstones which contain ostracods and *Earlandia* along with relict skeletal fragments. The successive 8 m-thick deposits consist of planar stromatolites with well-preserved microfabrics. The most characteristic microfabric elements are sphere clusters in a dense micrite groundmass, bushy aggregates of micrite clots, bundles of prostrate micrite threads, and peloids. The formation of the spheres and the surrounding dense micrite is attributed to calcification of a coccoid–cyanobacteria dominated mat community. The tufted micrite clot clusters crudely resemble *Angusticellularia*. A filamentous microbial origin is likely for the thread bundles. The peloids are interpreted either as reworked pieces of calcified mat, or rolled microbial clumps. The reduced preservation of microfabric components in the upper unit refers to less favourable condition for mat development which is probable due to deepening of the depositional environment. The overlying mudstone unit is very poor in fossils. The preservation of microbial microfabrics in the stromatolites indicates that early lithification by carbonate precipitation was widespread and intense even in open marine environments following the end-Permian boundary events. This supports the assumption that significant changes took place in geochemistry of seawater during the Late Permian–Early Triassic time interval.

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Siberian glaciation as a constraint on Permian–Carboniferous CO₂ levels

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ABSTRACT

Reconstructions of Phanerozoic CO₂ levels have generally relied on geochemical modeling or proxy data. Because the uncertainty inherent in such reconstructions is large enough to be climatically significant, inverse climate modeling may help to constrain paleo-CO₂ estimates. In particular, we test the plausibility of this technique by focusing on the climate from 360 to 260 Ma, a time in which the Siberian landmass was in middle to high latitudes, yet had little or no permanent land ice. Our climate model simulations predict a lower limit for CO₂—the value beneath which Siberia acquires “excess” ice. Simulations provide little new information for the period in which Siberia was at a relatively low paleoaltitude (360–340 Ma), but model results imply that paleo-CO₂ levels had to be greater than 2–43 modern values to be consistent with an apparently ice-free Siberia in the late Permian. These results for the later period in general agree with soil CO₂ proxies and the timing of Gondwanan deglaciation, thus providing support for a significant CO₂ increase before the end-Permian boundary event. Our technique may be applicable to other time intervals of unipolar glaciation.

Keywords: paleoclimate, paleoatmosphere, carbon dioxide, glaciation.

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Evolution of the System Earth in the Late Palaeozoic: Clues from Sedimentary Geochemistry ⁸⁷Sr/⁸⁶Sr record of Permian seawater

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Abstract

A population of 169 Permian articulate brachiopod shells was analysed for their ⁸⁷Sr/⁸⁶Sr ratios. 51 of these, characterised as well preserved and stratigraphically well defined, are utilized for delineation of the Permian seawater strontium isotope trend. The ⁸⁷Sr/⁸⁶Sr curve shows values of about 0.7080 in the lowermost Permian (Asselian), followed by a gradual decline to 0.70685 in the Capitanian and a minor rise in the Dzhulfian and lower Dorashamian to values of 0.70715 just below the Permian-Triassic boundary.

The Early Permian decrease in the strontium isotope curve that commences in the early Sakmarian is coincident with the advancing deglaciation of the Gondwana and with the increased aridity in large parts of the Pangaea. These factors may have led to a reduced continental weathering of Rb-rich silicate rocks, and thus to the decline in seawater ⁸⁷Sr/⁸⁶Sr. Starting with the Artinskian, the opening of the Neotethys and the associated widespread basaltic volcanism supplied low radiogenic strontium to seawater from an enhanced hydrothermal flux. In the Capitanian, basaltic volcanism in the entire Palaeotethys ceased and this may have been the reason for a slightly more radiogenic seawater isotopic composition during the Lopingian. Higher input of riverine Sr due to expansion of humid areas may have been a contributory factor.

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ViewAnisian palynomorphs from the Dont Formation of the Kühwiesenkopf/Monte Prà Della Vacca Section (Northern Italy), by Evelyn Kustatscher and Guido Roghi, page 31 - 52

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Review of Palaeobotany and Palynology Volume 140, Issues 1-2 , June 2006, Pages 79-90

New biostratigraphic data on Anisian (Middle Triassic) palynomorphs from the Dolomites, Italy

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Abstract

This paper proposes an integrated Anisian palynomorph and ammonoid biostratigraphy, mostly based on data obtained from two successions (Monte Prà della Vacca and Dont) in the Dolomites belonging to the Dont Formation. In these sections, different pollen assemblages have been recognized. Assemblage A is marked by the presence of *Aratrisporites reticulatus* and *Dyupetalum vicentinense*; it occurs in the lower part of the Dont Formation and uppermost *Gracilis* Formation, but no ammonoid has been found in this stratigraphic segment. Thus, it is currently not possible to calibrate it with ammonoids. On the basis of tentative correlations with other ammonoids-bearing sections and data in the literature, it is correlated to the middle Pelsonian (*Balaticus* Subzone p.p.). The assemblage has also been recognized in the Voltzia beds of Recoaro. Assemblage B occurs in the middle Dont Formation and is characterized by the first occurrence of *Cristianisporites triangulatus*. It contains ammonoids of the *Balaticus* and *Binodosus* Subzones, of middle-late Pelsonian age. Assemblage C, marked by the first occurrence of "*Krauselisporites*" sp. 1 sensu Roghi, 1995a characterises the upper part of the Dont Formation, where ammonoids of the *Abichi* and *Trinodosus* Subzones indicate an Illyrian age.

Keywords: palynomorphs; ammonoids; biostratigraphy; Anisian; Middle Triassic; Dolomites

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Magnetobiochronology of Lower Miocene (Ramblian) continental sediments from the Tudela Formation (western Ebro basin, Spain)

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Abstract

The calibration of European Lower Miocene continental stages is poorly constrained due to the lack of robust magnetostratigraphic data from continental sediments of this age. In this paper, we present the first magnetostratigraphic results from the mammal fossil-bearing continental sediments of the Lower-Middle Miocene Tudela Formation (western Ebro basin, Spain). The study is based on 331 paleomagnetic sites distributed along a 790-m-thick composite section. The resulting magnetostratigraphy provides an independent correlation to the geomagnetic polarity time scale and allows accurate dating of previously known and new Ramblian (upper Lower Miocene) fossil localities of the Tudela Formation.

The new age constraints derived for the Tudela Formation fossil localities provide, together with a reevaluation of other Iberian faunas, the first magnetostratigraphy for the Ramblian continental stage. The lower boundary of the Ramblian is placed at the lower part of chron C6r (ca. 20.4 Ma), and the boundary between the lower and upper Ramblian is located at the middle of chron C6n (ca. 19.6 Ma). The upper boundary of the Ramblian, and hence the base of the Aragonian, is placed at the upper middle part of chron C5Cr (16.8–17 Ma). Our results also provide the first magnetostratigraphically dated MN3 faunas in Spain, which, together with a reevaluation of other Iberian and European faunas, provide a revised calibration of European mammal zone MN3. The lower boundary of zone MN3 is placed at the boundary between chrons C6r and C6n (ca. 20.1 Ma), and its upper boundary is located at the upper middle part of chron C5Cr (16.8–17 Ma).

Keywords: Miocene; Ramblian; magnetostratigraphy; bio

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Données microanatomiques sur la conquête de l'environnement terrestre par les vertébrés

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Résumé

Des sections transversales du fémur de 46 espèces de lissamphibiens ont été étudiées pour déterminer la relation entre mode de vie (aquatique, amphibie ou terrestre) et profil de compacité osseuse. Deux tests statistiques, qui incorporent la phylogénie, démontrent que le retour à un mode de vie aquatique chez les lissamphibiens s'accompagne d'une augmentation de la compacité fémorale et d'une augmentation de la taille corporelle. Cependant, les espèces d'amphibiens ne peuvent être distinguées de leurs proches parents terrestres uniquement sur la base de leur compacité fémorale ou de leur taille corporelle. Un modèle mathématique obtenu en utilisant des régressions logistiques qui incorporent une pondération phylogénétique nous a permis d'inférer le mode de vie de quatre stégocéphales du Permien et du Trias. Les résultats sont cohérents avec les interprétations précédentes. De plus, ils suggèrent que cette méthode pourrait fournir de précieuses données sur le mode de vie des premiers stégocéphales.

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Synchronous palynofloristic extinction and recovery after the end-Permian event in the Prince Charles Mountains, Antarctica: Implications for palynofloristic turnover across Gondwana

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Abstract

In the Prince Charles Mountains (PCMs) the conformable Permian–Triassic (P–T) succession is characterised by an abrupt transition from coal-bearing to coal-lacking strata, which coincides with the demise of the Permian Glossopteris-dominated flora. About 32% of the typical Permian spores and pollen are registered for the last time in the uppermost coal. Throughout the earliest Triassic an additional 34% of the lingering Permian taxa disappear, while pioneering typical Triassic taxa appear. This interval of contemporaneous stepwise extinction and recovery resulted in an actual increase in spore-pollen taxa diversity during the earliest Triassic. The estimated average sedimentation rate indicates that the 24 m sampling gap that separates the last Permian assemblage from the first Triassic one represents ca 96 000 years, and that the continued stepwise extinction and recovery lasted for ca 325 000 years. In the aftermath of the end-Permian crisis only 27% of the typical Permian spores and pollen, that were present from the lower McKinnon Member in the Prince Charles Mountains survived to the late Induan, but by then the biodiversity had only decreased by less than 10%. Comparisons of Gondwanan palynological and lithological data indicate that intense global warming had already begun in the Permian, and that high latitude Gondwana areas such as the PCMs, were affected later than areas to the north and west. They also suggest that the end-Permian crisis affected the various Gondwana regions in different ways, but that the end result appears to have been a more equable, sub-humid to semi-arid, and less seasonal climate across southern Gondwana.

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Palaeontology Volume 49 Page 355 - March 2006 Volume 49 Issue 2

A REVIEW OF TRIASSIC TETRAPOD TRACK ASSEMBLAGES FROM ARGENTINA

by **RICARDO N. MELCHOR*** and **SILVINA DE VALAIS†**

Abstract: This paper contains the first comprehensive ichnotaxonomic review of the Triassic tetrapod track record in Argentina, including previous accounts and new material recently discovered, and an analysis of its composition and stratigraphic distribution. Triassic footprints have been recorded from three basins: the Ischigualasto-Villa Unión and Cuyo basins in north-west Argentina, and the Los Menucos depocentre in northern Patagonia. Most are in successions of Middle Triassic age; a lower number are from the Late Triassic, and there are two records from Early Triassic rocks. The known track types include: *Brachychirotherium* isp., cf. *Brachychirotherium* isp., *Chirotherium barthii*, *Dicynodontipus* isp., *Grallator* isp., *Rhynchosauroides* isp., *Rigalites ischigualastianus*, *Rigalites* isp., *Tetrasauropus* isp., and bird-like, chirotheriid and unidentified tridactyl footprints. The ichnogenera *Gallegosichnus* Casamiquela, 1964, *Calibarichnus* Casamiquela, 1964, *Palaciosichnus* Casamiquela, 1964 and *Stipanichnus* Casamiquela, 1975 are considered to be synonyms of *Dicynodontipus*

(Hornstein, 1876). In addition, the abandonment of the following ichnogenera (and single ichnospecies) that are based on poorly preserved material is suggested: *Ingenierichnus sierrai* Casamiquela, 1964, *Rogerbaletichnus aguileri* Casamiquela, 1964 and *Shimmelia chirotheroides* Casamiquela, 1964. At least eight Triassic ichnofaunas can be recognized. The most peculiar is that of the Late Triassic Los Menucos deponent, which is characterized by the dominance of therapsid footprints (*Dicynodontipus* spp.). The track assemblages from the Cuyo Basin display the highest ichnodiversity, with five footprint types.

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Evolution of the System Earth in the Late Palaeozoic: Clues from Sedimentary Geochemistry

Global time scale and regional stratigraphic reference scales of Central and West Europe, East Europe, Tethys, South China, and North America as used in the Devonian–Carboniferous–Permian Correlation Chart 2003 (DCP 2003)

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Abstract

The boundaries of the Devonian, Carboniferous, and Permian stages of the Global Stratigraphic Reference Scale (abbreviated to Global Stratigraphic Scale—GSS) are described in relation to the biostratigraphic and/or lithostratigraphic units of the Regional Stratigraphic Reference Scales (abbreviated to Regional Stratigraphic Scales—RSS) of Central and West Europe, East Europe, Tethys, South China (eastern Tethys), and North America. In their type regions the boundaries of GSS units rarely coincide with those of homonymous RSS units. Moreover, the definitions of some RSS units have changed several times over the last decades, and subsequent misunderstanding of the stratigraphical significance of these changes has often introduced errors into proposed global correlation charts. The stratigraphic framework proposed in our global Devonian–Carboniferous–Permian Correlation Chart 2003 [DCP 2003 (Devonian–Carboniferous–Permian Correlation Chart 2003, Menning, M., Schneider, J. W., Alekseev, A. S., Amon, E. O., Becker, G., von Bitter, P. H., Boardman, D. R., Bogoslovskaya, M., Braun, A., Brocke, R., Chernykh, V., Chuvashov, B. I., Clayton, G., Dusar, M., Davydov, V. I., Dybova-Jachowicz, S., Forke, H. C., Gibling, M., Gilmour, E. H., Goretzki, J., Grunt, T. A., Hance, L., Heckel, P. H., Izokh, N. G., Jansen, U., Jin Y.-G., Jones, P., Käding, K.-Ch., Kerp, H., Kiersnowski, H., Klets, A., Klug, Ch., Korn, D., Kossovaya, O., Kotlyar, G. V., Kozur, H. W., Laveine, J.-P., Martens, Th., Nemyrovsk a, T. I., Nigmatdaganov, A. I., Paech, H.-J., Peryt, T. M., Rohn, R., Roscher, M., Rubidge, B., Schiappa, T. A., Schindler, E., Skompski, S., Ueno, K., Utting, J., Vdovenko, M. V., Villa, E., Voigt, S., Wahlman, G. P., Wardlaw, B. R., Warrington, G., Weddige, K., Werneburg, R., Weyer, D., Wilde, V., Winkler Prins, C. F., Work, D. M., 2004). Abschlußkolloquium DFG-Schwerpunktprogramm 1054: Evolution des Systems Erde während des jüngeren Paläozoikums im Spiegel der Sedimentgeochemie. Abstracts Univ. Erlangen, Germany, 2004, p. 43.] (herein abbreviated to DCP 2003, and cited as DCP, 2003 in references) is an attempt to reduce these errors.

The DCP 2003 is the stratigraphic base for Project 1054 of the Deutsche Forschungsgemeinschaft (DFG) "The evolution of the Late Palaeozoic in the light of sedimentary geochemistry". This composite time scale has been carefully balanced, as far as data allows, to remove unnecessary, artificial compression and expansion of time intervals, biozonations and depositional events. The ages selected in DCP 2003 are markedly different to those in the Geologic Time Scale 1989 [GTS 1989 (Harland, W.B., Armstrong, R.L., Cox, A.V., Craig, L.E., Smith, A.G., Smith, D.G., 1990). A geologic time scale 1989. Cambridge Univ. Press, Cambridge.; Harland, W.B., Armstrong, R.L., Cox, A.V., Craig, L.E., Smith, A.G., Smith, D.G., 1990. A geologic time scale 1989. Cambridge Univ. Press, Cambridge, pp. 1–263.] and in Gradstein and Ogg [Gradstein, F.M., Ogg, J., 1996. A Phanerozoic time scale. Episodes 19 (1/2), 3–4, insert.), whereas they are closer to those of the Geologic Time Scale 2004 [GTS 2004; Gradstein, F.M., Ogg, J.G., Smith, A.G., 2004. A Geologic Time Scale 2004. Cambridge Univ. Press, Cambridge, pp. 1–589.]. Mostly, the ages are rounded to the nearest 0.5 Ma in order to avoid estimates of questionable accuracy, whereas ages of 0.1 Ma in the GTS 2004 and their error bars of ± 0.4 Ma to ± 2.8 Ma for the Devonian to Permian stage boundaries suggest an improved accuracy. In contrast, in the DCP 2003 questionable ages and positions of stratigraphic boundaries are marked by arrows.

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Fusulinoidean characterization of the uppermost Moscovian-Gzhelian (upper Pennsylvanian) synorogenic depositional sequences from northern Picos de Europa Unit (Spain)

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Abstract

Late Pennsylvanian succession of the Picos de Europa Unit (Cantabrian Mountains, NW Spain) constitutes one of the few exposed marine strata of this age in Western Europe. It consists of synorogenic deposits that accumulated in piggy-back basins developed during the latest stages of the Variscan orogeny. The 11 mappable 3rd, 4th–5th order depositional sequences that form the succession were subdivided in higher-order cycles (5th order) and grouped into two sequence sets. Fusulinoidean faunas have allowed dating of these strata (late Myachkovian-Gzhelian) and to characterize each depositional sequence. Sequence stratigraphy, coupled with sedimentological and paleontological analysis have enabled the reconstruction of a sea level curve that may shed light on Late Pennsylvanian global events and faunal migrations. These studies suggest potential correlations between late Moscovian cycles recognized both in the Cantabrian Mountains and in the Moscow Basin. Sudden appearances of early Dorogomilovian and early Gzhelian fusulinoideans could indicate migrations within the Paleotethys, probably favoured by global sea level rises and highstands.

Keywords Late Pennsylvanian - Sequence stratigraphy - Fusulinoideans - Biostratigraphy - Cantabrian Mountains - Picos de Europa

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Carboniferous–Permian magmatism in the Midland Valley of Scotland: implications for regional tectonomagmatic evolution and the numerical time scale

Authors: Monaghan, Alison A.1; Parrish, R.R.2

Abstract:

Four new U–Pb isotope dilution thermal ionization mass spectrometry dates from Carboniferous igneous rocks of the Midland Valley of Scotland are integrated with 16 recently published $^{40}\text{Ar}/^{39}\text{Ar}$ dates. The numerical and stratigraphical ages of the dated samples are compatible to stage level, allowing improved intrabasinal and regional correlations. Early Carboniferous extension-related volcanism in the Midland Valley was pulsed, with a date of 343.4 ± 1.0 Ma from the Garleton Hills Volcanic Formation and dates of 334.7 ± 1.7 and 335.2 ± 0.8 Ma from the Clyde Plateau Volcanic Formation. The magmatic pulses are synchronous with synrift phases in the Northumberland–Solway Basin. Volcanism continued in mid- to Late Carboniferous time contemporaneous with dextral strike-slip tectonics, in contrast to a post-rift tectonic setting in northern England. After Late Carboniferous basin inversion, tholeiitic magmatism dated at 307.6 ± 4.8 Ma provides a maximum Westphalian D age for

post-Variscan magmatism and extension–dextral transtension across Scotland and northern England. In the Early Permian, as rift systems developed across NW Europe, alkaline extension-related magmatism resumed in the Midland Valley from c. 298 to 292 Ma. The improved geochronology provides important data for poorly constrained parts of the numerical Carboniferous time scale such as stages within the Viséan, and provides a well-controlled tie-point that supports a Tournaisian–Viséan boundary age of c. 345.4 Ma.

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Journal of Paleontology: Vol. 80, No. 4, pp. 726–739.

THE BASAL REPTILE THURINGOTHYRIS MAHLENDORFFAE (AMNIOTA: EUREPTILIA) FROM THE LOWER PERMIAN OF GERMANY

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ABSTRACT

The skeletal anatomy of the Early Permian eureptile *Thuringothyris mahlendorffae* from the Bromacker Quarry, Germany, is redescribed on the basis of several new specimens. The taxon retains some plesiomorphic characters, such as an ectopterygoid and a tabular, but it also possesses low neural spines and nonswollen neural arches, a combination that is unique for early eureptiles. A phylogenetic analysis places *Thuringothyris* as the sister taxon of Captorhinidae, excluding any potential “protorothyridid” affinities. Implications of this study are that the swollen neural arches of captorhinids and araeosceloids might have evolved independently, that a downturned rostrum occurred only later in captorhinid evolution, and that the European Permian is important to the understanding of the origin of eureptiles.

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 240, Issues 1-2 , 6 October 2006, Pages 204-224

Evolution of the System Earth in the Late Palaeozoic: Clues from Sedimentary Geochemistry

Reconstructing the evolution of the latest Pennsylvanian–earliest Permian Lake Odernheim based on stable isotope geochemistry and palynofacies: A case study from the Saar-Nahe Basin, Germany

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Abstract

Finely laminated sediments archived the evolution of the latest Pennsylvanian–earliest Permian Lake Odernheim, Saar-Nahe Basin, Germany. A succession of evolutionary stages can be distinguished based on variable carbonate carbon (– 5 to + 2‰) and oxygen (– 7 to + 5‰) isotopic compositions of dolomite. Sedimentary organic matter represents primarily a mixture of detrital vascular plant material ($\delta^{13}\text{C}$ around – 21‰) and lake derived photosynthetic algal matter ($\delta^{13}\text{C}$ around – 27‰). This distinction based on organic carbon isotopes is further supported by palynofacies analyses and Rock-Eval data. An additional contribution from bacterial biomass is likely. Bacterial sulphate reduction, and thus anaerobic remineralization of sedimentary organic matter, is indicated by the presence of sedimentary pyrite.

Observed geochemical changes are attributed to temporal variations in the water balance of Lake Odernheim, including times of stronger evaporation as well as times showing substantial input of freshwater.

Keywords: Carbonate; Organic carbon; Carbon isotopes; Oxygen isotopes; Palynofacies; Lake evolution

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Late Permian (Changhsingian) conodont biozonation and the basal boundary, Ganxi section, western Hubei Province, south China

Mutwakil Nafi, Xia Wenchen, and Zhang Ning

Abstract: Four neogondolellid conodont interval zones were recognized across the Changhsingian stage at Ganxi section, western Hubei Province, south China. They are in ascending order: the *Clarkina wangi* Zone, the *Clarkina changxingensis* Zone, the *Clarkina changxingensis yini* Zone, and the *Clarkina meishanensis meishanensis* Zone. The present study suggests that the base of the Changhsingian can be defined by the first appearance datum (FAD) of *Clarkina wangi* within an evolutionary lineage from *Clarkina longicuspidata* to *Clarkina wangi*. The Wuchiapingian–Changhsingian boundary can be placed at the base of bed 104 at Ganxi section, south China because of the first occurrence of *Clarkina wangi*.

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Micropaleontology, vol. 52, No. 1, 2006

View Middle Permian (Late Guadalupian) foraminifers from Dark Canyon, Guadalupe Mountains, New Mexico, by Galina P. Nestell and Merlynd K. Nestell, page 1 - 50

View *Velatomorpha*, a new healdioidean ostracode genus from the early Pennsylvanian Joggins Formation, Nova Scotia, Canada, by Neil E. Tibert and Christopher P. Dewey, page 51 - 66

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Earth and Planetary Science Letters Volume 243, Issues 3-4 , 30 March 2006, Pages 463-475

New Early to Middle Triassic U–Pb ages from South China: Calibration with ammonoid biochronozones and implications for the timing of the Triassic biotic recovery

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Abstract

New zircon U–Pb ages are proposed for late Early and Middle Triassic volcanic ash layers from the Luolou and Baifeng formations (northwestern Guangxi, South China). These ages are based on analyses of single, thermally annealed and chemically abraded zircons. Calibration with ammonoid ages indicate a 250.6 ± 0.5 Ma age for the early Spathian Tirolites/Columbites beds, a 248.1 ± 0.4 Ma age for the late Spathian *Neopopanoceras haugi* Zone, a 246.9 ± 0.4 Ma age for the early middle Anisian *Acrochordiceras hyatti* Zone, and a 244.6 ± 0.5 Ma age for the late middle Anisian *Balatonites shoshonensis* Zone. The new dates and previously published U–Pb ages indicate a duration of ca. 3 my for the Spathian, and minimal durations of 4.5 ± 0.6 my for the Early Triassic and of $6.6 + 0.7/- 0.9$ my for the Anisian. The new Spathian dates are in a better agreement with a 252.6 ± 0.2 Ma age than with a 251.4 ± 0.3 Ma age for the Permian–Triassic boundary. These dates also highlight the extremely uneven duration of the four Early Triassic substages (Griesbachian, Dienerian, Smithian, and Spathian), of which the Spathian exceeds half of the duration of the entire Early Triassic. The simplistic assumption of equal duration of the four Early Triassic subdivisions is no longer tenable for the reconstruction of recovery patterns following the end Permian mass extinction.

Keywords: U–Pb ages; zircon; Early Triassic; ammonoids; biotic

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Issues 1-2, Pages 1-178 (12 December 2005)

Permian-Triassic Transition in Spain: A multidisciplinary approach

Edited by Jose Lopez-Gomez and Edith L. Taylor

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José López-Gómez and Edith L. Taylor
Abstract | Full Text + Links | PDF (66 K) | To Purchase and Download the Full Article, Click PDF

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Abstract | Full Text + Links | PDF (3626 K) | To Purchase and Download the Full Article, Click PDF

11. Early oysters and their supposed Permian ancestors • ARTICLE

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12. Foraminiferal fauna recovered after the Late Permian extinctions in Iberia and the westernmost Tethys area • ARTICLE

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Leopoldo Márquez

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13. “Buntsandstein” magnetostratigraphy and biostratigraphic reappraisal from eastern Iberia: Early and Middle Triassic stage boundary definitions through correlation to Tethyan sections • ARTICLE

Pages 158-177

Jaume Dinarès-Turell, José Bienvenido Diez, Daniel Rey and Isabel Arnal

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 232, Issue 1 , 8 March 2006, Pages 53-72

Multi-proxy paleosol evidence for middle and late Triassic climate trends in eastern Utah

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Abstract

Prior investigations suggest that alluvial lowlands of Pangea in the southwestern U.S.A. during the middle to late Triassic experienced an arid to semiarid climate with significant seasonality. Our investigation finds evidence for a global pluvial episode from paleosols in the middle to late Triassic section of eastern Utah. Multi-proxy paleosol evidence is used to quantify rainfall amounts, ambient temperatures and atmospheric CO₂ concentrations and infer associated plant formations related to ecosystem persistence. Rainfall estimates are derived from geochemical molecular weathering ratios; temperature and atmospheric CO₂ levels from stable oxygen and carbon isotopes of pedogenic carbonate, respectively; and ecosystem reconstruction by a combination of climate indexes and paleosol characteristics. Eight pedotypes were identified and include poorly drained aquic Entisols (Fisher), well-drained non-aquic Entisols (Salt Valley), calcic Aridisols (Castle Valley), calcic Inceptisols (Moab), cambic (Ute) and calcic (La Sal) Vertisols, dystric Inceptisols (Kokopeli), and argillic Alfisols (Slickrock). The middle Triassic Moenkopi Formation (Anisian) was dominated by Castle Valley paleosols with mean annual rainfall between 300 and 400 mm and mean annual temperature between 13 and 23 °C (mesic to hyperthermic). Based on these climate indexes and root traces, the associated plant formation was most likely desert shrub or dry woodland. The lower Chinle Formation (Carnian) contains a succession of Ute and La Sal paleosols that changed up-section to Kokopeli, Fisher and Slickrock paleosols. In accordance with geochemical and isotopic signatures from these pedotypes, rainfall amounts initially increased to between 700 and 900 mm, and then to between 1300 and 1400 mm. Temperatures estimated from the La Sal paleosol are approximately 18 °C (thermic) at this time. The lower Chinle marks a transition from dry woodland to open forest that appears to correlate with the formation of the Petrified Forest Member in Arizona. The upper Chinle Formation (Carnian–Norian) reveals a return to semiarid to subhumid conditions and the formation of Castle Valley, Moab and Salt Valley paleosols, all of which appear to have supported desert shrub or dry woodlands. Rainfall amounts decreased to between 400 and 600 mm with temperatures eventually increasing to 29 °C (hyperthermic). Using the paleosol isotopic barometer, atmospheric CO₂ estimates generally correlate with other proxy for the Triassic. The well-developed Alfisols and noncalcareous Inceptisols identified during the Carnian of the lower Chinle correlate with a previously identified global pluvial episode based on sedimentological and marine isotopic evidence, possibly in response to rifting of Pangea. It should not be assumed that the middle to late Triassic in continental alluvial lowlands supported a uniform, semiarid to arid climate, with strong seasonality.

Keywords: Carbon dioxide; Chinle; Paleoclimate; Paleosol;

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A global marine sedimentary response to the end-Permian mass extinction: Examples from southern Turkey and the western United States

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Received 1 September 2005; accepted 16 May 2006

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Abstract

The end-Permian mass extinction greatly diminished marine diversity and brought about a whole-scale restructuring of marine ecosystems; these ecosystem changes also profoundly affected the sedimentary record. Data presented here, attained through facies analyses of strata deposited during the immediate aftermath of the end-Permian mass extinction (southern Turkey) and at the close of the Early Triassic (southwestern United States), in combination with a literature review, show that sedimentary

systems were profoundly affected by: (1) a reduction in biotic diversity and abundance and (2) long-term environmental fluctuations that resulted from the end-Permian crisis. Lower Triassic strata display widespread microbialite and carbonate seafloor fan development and contain indicators of suppressed infaunal bioturbation such as flat-pebble conglomerates and wrinkle structures (facies considered unusual in post-Cambrian subtidal deposits). Our observations suggest that depositional systems, too, respond to biotic crises, and that certain facies may act as barometers of ecologic and environmental change independent of fossil assemblage analyses. Close investigation of facies changes during other critical times in Earth history may serve as an important tool in interpreting the ecology of metazoans and their environment.

Keywords: Early Triassic; biotic recovery; Lower Triassic; western United States; southern Turkey
long-term delay in recovery of the biota.

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A NEW BURNETIAMORPH (THERAPSIDA: BIARMOSUCHIA) FROM THE MIDDLE PERMIAN OF SOUTH AFRICA

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ABSTRACT

The skull of a carnivorous therapsid from the Tapinocephalus Assemblage Zone of the Beaufort Group, Middle Permian of South Africa, is described as a new burnetiamorph biarmosuchian. *Pachydesmus elsi* n. gen. and sp. is distinguished from all other therapsids by its possession of a conspicuous pachyostotic maxillary boss that sheathes the root of the upper canine. It shares the presence of a preparietal ossification with other biarmosuchians and a pachyostotic boss below the postorbital bar with other burnetiamorphs. *Pachydesmus* is the first burnetiamorph known from along the Ecca-Beaufort contact in the eastern part of the Karoo Basin and only the second burnetiamorph to be described from the Tapinocephalus Assemblage Zone. All other South African burnetiamorphs, save *Bullacephalus jacksoni*, are known from much younger biozones of the Beaufort Group. Our phylogenetic analysis links *Pachydesmus* and *Bullacephalus*, which are the stratigraphically lowest-occurring taxa, with *Burnetia*, the burnetiamorph known from the highest position in the lower Beaufort Group. This result suggests that most of the history of biarmosuchians in South Africa is unrecorded.

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Carbonitidae (Ostracoda): ontogeny, affinity, environment and systematics

Authors: Retrum, Julie B.1; Kaesler, Roger L.

Source: Journal of Micropalaeontology, Volume 24, Number 2, 2005, pp. 179-190(12)

Abstract:

An assemblage of four *Carbonita* species was deposited with charophytes, lungfishes and lysorophids in a lenticular mudstone from a Cisuralian freshwater pond deposit from the lowest Permian. Samples contained few adult *Carbonita*, indicating perhaps a stressed and unstable environment. Two species new to science, *C. ovata* n. sp. and *C. triangulata* n. sp., occur together with *C. evelinae* and *C. pungens*. Morphological characters of these *Carbonita* suggest an affinity with the Healdioidea, marine taxa that are probably ancestral to the Carbonitidae. The muscle-scar patterns of Carbonitidae, which comprise closely grouped circular bundles of secondary muscle scars, resemble closely those of Healdioidea and not those of Cypridoidea and Cytheroidea, whose muscle scars are fewer and spaced further apart. The muscle-scar pattern of *C. pungens*, described here for the first time, is a circular scar with an ascertainable pattern of secondary scars. *C. pungens* and species of *Darwinula* are morphologically similar, but study of additional specimens of *C. pungens* with better-preserved muscle scars is essential to determine their evolutionary affinity. *J. Micropalaeontol.* 24(2): 179–190, October 2005.

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Xenotime in the Lower Buntsandstein of Central Europe: Evidence from cathodoluminescence investigation

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Abstract

Xenotime and zircon in heavy mineral separates of siliciclastic sediments can easily be distinguished by means of cathodoluminescence (CL). All shades of bright blue, yellow and grey to white colours have been reported for zircon while only bottle green to greenish yellow colours have been found in xenotime in heavy mineral separates of Lower Buntsandstein samples as well as in two samples from crystalline rocks from Bahia (Brazil) and the Karpaty Mts. (Slovakia). The CL-spectra of both minerals are commonly dominated by narrow emission bands of rare earth elements, especially Dy³⁺. The two different crystal lattices induce differences in the intensity ratios of the emission lines that are thought to be the reason for the different CL-colours. Additionally, intrinsic broad bands that may occur in the CL-spectra of zircon are missing in the xenotime spectra. The possibility to distinguish minerals with similar optical properties underlines the large potential of cathodoluminescence in sedimentary petrology.

Keywords: Cathodoluminescence spectroscopy; Xenotime; Zircon; Rare earth elements; Heavy

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Review of Palaeobotany and Palynology Volume 140, Issues 3-4 , July 2006, Pages 145-162

Sphenopsids of the Permian (I): The largest known anatomically preserved calamite, an exceptional find from the petrified forest of Chemnitz, Germany

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Abstract

The stem anatomy and internal organisation of a newly collected sphenophyte trunk is studied from the type locality of Arthropitys, the Lower Permian petrified forest of Chemnitz, Germany. The trunk was found nearly in situ, still standing upright, and embedded in coarse-grained pyroclastics of the Zeisigwald Tuff Horizon (Leukersdorf Formation, Erzgebirge Basin). This specimen – the basal portion of a huge woody tree measuring up to 60 cm in diameter – represents the largest anatomically preserved calamite trunk ever found. On the basis of current investigation the exceptional find has been attributed to *Arthropitys ezonata* Goepfert, which is more completely characterised and emended herein. This species is characterised by its rather homogeneous loose wood without clearly distinct interfascicular rays and fascicular wedges. For the first time we are able to show details of the primary body of this poorly understood species such as vascular strands and pith parenchyma. Comparisons are made with the generitype *Arthropitys bistriata* (Cotta) Goepfert and other species of the genus *Arthropitys*.

Keywords: Arthropitys; sphenopsids; stem anatomy; permineralisation; Permian

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Interests of studying bone histology for a better understanding of the ontogeny of stegocephalians from the Palaeozoic.

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Summary

The ontogeny of stegocephalians, mostly temnospondyls, has long been studied thanks to the relatively large number of specimens and especially to their growth series. Anatomical data can be completed by histological data to better answer to ontogenetical questions. Recent bone histological data of a small seymouriamorph from the Lower Permian of Czech Republic, *Discosauriscus austriacus*, have permitted to interpret the life-history traits of this species on the basis of growth stages. The long bone histology of *D. austriacus* is very similar to that of extant small lissamphibians, with lamellar to parallel fibered bone matrix: the bone tissue type revealed a slow periosteal growth rate like that of recent Caudata but a faster epiphyseal growth rate. Lines of arrested growth (LAGs) have permitted to assess the age of a growth series of thirteen individuals of *D. austriacus* from five to ten years old. By comparison with anatomical data, the metamorphosis, revealed by morphological changes, would occur at the age of eight to nine. The three last peripheral LAGs seem to be closer to each another in the long bones of the largest specimen. This suggests that the periosteal growth rate began to slow from the age of seven to eight. Thus, the oldest individual of the sample would be a late juvenile or subadult, i.e. about to reach its sexual maturity. These preliminary results on *D. austriacus* will be compared with others stegocephalians which ontogeny is well documented (*Apateon*, *Sclerocephalus*). Such studies will allow to better understand the early tetrapods' ontogenies.

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 242, Issues 1-2 , 24 November 2006, Pages 68-89

Evidence for a fungal event, methane-hydrate release and soil erosion at the Permian–Triassic boundary in southern Israel

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Abstract

The transition between the Permian and the Triassic systems in Israel is evident only in the subsurface. Two cores, from the Makhtesh Qatan 2 (core 9) and Avedat 1 (core 5) drillholes, in which the Permian–Triassic boundary was found marked by a fungal event, were sampled at close intervals and analysed for palynological, petrographical, mineralogical, chemical, and isotopic properties. Three palynozones were recorded: Lueckisporites virkkia Zone (Late Permian), Fungal Event, and Endosporites papillatus Zone (Early Triassic). The Fungal Event occurs in a narrow interval of 1 m and contains almost exclusively fungal remains and recycled woody particles. The two cores consist of laminated sediments, mainly siliciclastic, that were deposited in very shallow to restricted marine environments with a minor presence of evaporites and no bioturbation. Green glauconitic material and framboidal pyrite suggest suboxic conditions even in the shallow waters; reddish brown particles and plant fragments derived from nearby soils, now outcropping on the northeast side of the Dead Sea. These materials, as well as recycled brown glauconitic grains, suggest a drop in sea level and intense erosion before sedimentation, which was apparently continuous. Major and trace element compositions, including rare-earth elements, do not exhibit any particular pattern that might be related to the Fungal Event or to other core intervals. The rare-earth element patterns are basically normal and their concentration correlates with the clay content, reflecting the provenance of the Arabo-Nubian Massif and its sedimentary rims. Iridium results were mostly at the background level, and therefore the two distinct anomalous values are inconclusive. Microspherules, mainly of 2 µm size and Al–Si composition, were observed in a few samples in both cores. Their origin could not be determined, though they are considered to be natural. There was no evidence for shocked quartz. δ¹³C_{org} excursion exhibits a marked negative shift in both cores, just below the Fungal Event. The lowest values, –37‰ and –42‰, are among the lowest ever recorded near the Permian–Triassic boundary and suggest large-scale release of methane-hydrates.

Keywords: Permian–Triassic boundary; Fungal Event; Rare Earths; Organic carbon; Microspherules

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Sedimentary Geology Volume 187, Issues 3-4 , 1 June 2006, Pages 205-227

Sedimentary facies and the context of dolocrete in the Lower Triassic Sherwood Sandstone group: Corrib Field west of Ireland

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Abstract

The Lower Triassic Sherwood Sandstone Group (SSG) reservoir in the Corrib Field is predominantly fine- to medium-grained fluvial sandstone with minor aeolian and playa sediments that formed under semi-arid to arid conditions. There is no evidence of roots, burrows or organic-rich soils in the SSG suggesting an environment with sparse vegetation in the catchment and sedimentation from a predominantly braided sand-dominated river. Dolomite is the main porosity-occluding cement (< 25 vol.%) in the Sherwood Sandstone Group reservoir in the Corrib Gas Field, offshore west of Ireland. Dolomite is demonstrably early diagenetic since it is non-ferroan, brightly luminescent, occurs in rocks with high (uncompacted) intergranular volumes and grew before all burial diagenetic cements. Conversely, calcrete is the dominant early diagenetic cement in well 27/5-1 in the SSG, 50 km south of Corrib. Dolocrete and/or calcrete are represented throughout the entire SSG interval and typically form under conditions of very low sediment accumulation rates. Dolocrete occurs equally in all facies showing that it is not a result of depositional processes. Core goniometry data in the Corrib Field revealed that the general palaeoflow direction was from south to north. During progressive evaporation of river- and ground-water calcite formed first, followed by dolomite further downstream with gypsum formed last if evaporation continues. This well-established pattern indicates that well 27/5-1 has calcrete and Corrib has dolocrete since they both result from evaporative concentration of ground- and river-water during flow down the very shallow Triassic palaeogradient.

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 240, Issues 1-2 , 6 October 2006, Pages 161-183
Evolution of the System Earth in the Late Palaeozoic: Clues from Sedimentary Geochemistry

Permian climate development in the northern peri-Tethys area — The Lodève basin, French Massif Central, compared in a European and global context

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Abstract

The Lodève basin, which contains an exceptional long and nearly uninterrupted profile of Early to Late Permian continental red beds, is well correlated to the other European Permian carboniferous basins. Together they cover the time span from the Late Pennsylvanian to the Permian–Triassic boundary. Although these basins were placed within the equatorial belt for the whole Permian, several climatic changes are recorded in the sediments. Terrestrial sedimentation is governed by the interaction of climate and tectonics as well as by volcanism to a variable degree. Therefore, small scale climatic variations of the Milankovitch band are hardly discernable and if so, they could not be correlated between different basins. Indeed, larger scale climatic shifts could be identified.

It is shown, that the shift from the Carboniferous icehouse to the Mesozoic greenhouse was a multi-stage process. This global warming resulted in a general aridisation of northern Pangea, indicated by outspreading playa and sabkha red beds, aeolianites and evaporites. Several short phases of increased humidity interrupted this trend, indicated by wet red beds, lake sediments and coal deposits. In central and southern Europe, these wet periods are traceable within the Late Stephanian/Lower Rotliegend (Gzhelian/Asselian), topmost Lower Rotliegend (Asselian/Sakmarian), Upper Rotliegend I (late Artinskian/early Kungurian) and Upper Rotliegend II/Zechstein (Wuchiapingian). The aridisation of the northern Pangea which accelerated near the Sakmarian/Artinskian transition is attributed to a reorganisation of the major ocean currents. Cold water currents along the western flank of the Pangea, indicated by the Permian chert event, blocks moisture transport from West onto the continent. During Roadian and Wordian the onset of an additional cold water current along the Cimmerian continents, blocks moisture transport from the East. Both phenomena together are responsible for the maximum of aridity at the Early to Middle Permian transition.

Additionally, the equatorial climate has been affected by an increasing seasonality within the Late Pennsylvanian and Permian, caused by the wide shifting of the Zone of Inter-tropical Convergence (ITC) over the equator. Based on a new reconstruction of the Pangean assembly in this paper, climatic changes in the Permian are interpreted and causes of the arid-humid-arid shifts are examined. Phases of higher humidity are often related to events of global impact, like the waxing and waning of the Gondwanan glaciation, obtained in the South African Karoo Basin (Dwyka Group). But also regional events had strong climatic influence. The Zechstein transgression in the Northern and Southern Permian Basin as well as the Bellerophon transgression of the Southern Alps caused the wet phase in the Wuchiapingian.

A complete Trematosaurid amphibian from the middle Triassic of Germany

RAINER R. SCHOCH,

Recent finds of small temnospondyls from the Lower Keuper (Ladinian, Middle Triassic) of southern Germany are referred to a new trematosaurid genus and species, *Trematolestes hagdorni*. It is the first trematosaurid represented by a nearly complete skeleton. *Trematolestes* is characterized by an unpaired frontal and a minute lacrimal at the orbital rim wedged in between an extensive prefrontal and a wide maxilla. Further characteristic are keeled, laterally compressed palatal tusks, a strong palatine and ectopterygoid dentition, and minute maxillary and posterior dentary teeth. In the visceral skeleton, ceratobranchial parts of the hyobranchial skeleton and an unpaired basibranchial element are ossified. The ribs bear pronounced spine-like uncinat processes throughout the trunk and anterior tail skeleton. The forelimb is minute, with a strongly abbreviated humerus not exceeding the length of the lower arm, rudimentary radius and ulna, and a small, probably four-fingered hand skeleton. Unlike the situation in capitosauroids, the trunk was deep with an elongated recurved ilium and a highly modified sacral rib. The trunk is composed of 22 vertebrae, while the caudal vertebral count is at least 24, but probably exceeded 30. Phylogenetic analysis suggests that *Trematolestes* is closely related to the Madagascan genus *Tertremoides* and together they are nested with the rostrumbearing slender-headed lonchorhynchines.

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Palaeogeography, Palaeoclimatology, Palaeoecology 231 (2006) 315– 321

Abrupt chemical weathering increase across the Permian–Triassic boundary

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Abstract

Previous studies have suggested a variety of causes for the end-Permian extinction event including a bolide impact, flood basalt volcanism, methane clathrate dissociation, or some combination of catastrophic processes. One common feature of these hypotheses is the prediction of an enhanced earliest Triassic greenhouse. New high-resolution geochemical results from Graphite Peak, Antarctica support an abrupt increase in chemical weathering in the earliest Triassic among otherwise genetically similar paleosols of similar provenance. Relative to the latest Permian paleosols, the earliest Triassic paleosol exhibits greater leaching, greater accumulation of immobile REEs, and evidence of lower soil pO₂. With no evidence of an erosional unconformity between the paleosols, which are separated by 15 cm stratigraphically, these results support a rapid shift (perhaps 10,000 years) to an earliest Triassic greenhouse and a role for methane release in the extinction event and its aftermath.

Keywords: Methane; Antarctica; P-T boundary; Paleosols; Greenhouse

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Pages 541-554**

Extremely distal fluvial sandstone within the playa system of Arnstadt Formation (Norian, Late Triassic), Central Germany

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Abstract The Wachsenburg Sandstone of Thuringia (Central Germany) occurs within playa deposits of the Arnstadt Formation (Late Triassic, Norian) and furnishes an example of ephemeral river metamorphosis under dryland conditions. Characterized by high flow regime features, the sand-dominated lithofacies constitution exhibits sedimentation by channel processes under the influence of recurring flash floods. Bearing signatures of subaerial exposures, the fining-upward lithofacies cycles are bound by low-angle lateral accretion elements suggesting deposition in a meandering stream. Channel migration in response to point bar expansion and active bank erosion, led to the development of four laterally shifting point bar events. Unimodal

palaeocurrent patterns with low variance and azimuthal dispersion support the point bar origin of the Wachsenburg Sandstone. With reduced water budget under largely semi-arid climate, the river progressively became smaller, highly sinuous and ultimately abandoned. The resulting point bar succession was finally covered with sheet flow deposits of over bank origin. The sandstone was deposited during a period of low base-level when the playa system temporarily fell dry.

Keywords Ephemeral river - Meandering river - Flash flood - Playa system - Triassic (Norian) - Germany

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New fossils from the ?Permian and Triassic of Turkey shed light on Tethyan palaeogeography.

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Summary

The Mesozoic of Turkey is still poorly known as for vertebrate palaeontology. This has unfortunate implications for our understanding of the geodynamic reconstructions of Turkey through Mesozoic time: the location of the country during the Triassic Period is highly debated on Pangaeian maps. Turkey has a key position in the Tethys realm, but the locations of the various bits of the country remain controversial: Turkey is either considered as a single and large island in northern Tethys (Lucas & Hubert 2003); or is fragmented into two blocks 2000 km apart, one block on the northern Tethyan coast, and the other one located on the southern Tethyan coast (Scotese 2001, see Fig.1).

In order to test these global reconstructions, two field missions (2004, 2005) were planned in two (mainly) Triassic Formations from northern and southern Turkey; respectively the Çakraz and the Cenger Formations. The comparison of Mesozoic vertebrates from northern and southern Turkey may bring independent and significant constraints. In the Pontides (N. Turkey), the Çakraz Formation is represented by red beds grading in places into lake grey deposits, the Çakrazboz Formation. No bodyfossil was found up to now in the Çakraz Formation, yet Late Triassic palynomorphs were known within the lake deposits (Alişan & Derman 1995). The Çakraz Formation recently yielded palaeosol facies (gypsum, mudcracks), macroflora attributed to Euramerican Carboniferous-Permian plant remains; Stigmara-like impression (= Lycophte root system), typical *Annularia* whorls (aff. *Annularia radiata*), as well as possible swimming invertebrate traces, and interesting fossil tetrapod trackways. These trackways, the very first ones from Turkey, are referred to *Hyloidichnus*, an ichnogenus known in the Saxonian Group, Permian of the Lodève basin, southern France, or in Morocco. In spite of the lack of fossil vertebrates, the ichnofaunal

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18ème Congrès Mondial du Groupe des Spécialistes des Crocodiles, La Ferme aux Crocodiles, Pierrelatte (26), 19-24 juin 2006

Comparisons, adaptations and evolving convergences between fossil amphibians and living crocodiles.

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Summary

Living amphibians (or lissamphibians, i.e. frogs, salamanders and apodians) are mostly protected species and unfortunately correspond to a decline group. Their morphologies do not resemble those of the living crocodylians. However, in the past, fossil amphibians (as non-amniotic tetrapods) correspond to a very diverse group of numerous organisms appeared before crocodylians, i.e. about 370 Million years ago (Upper Devonian) if not before (Middle Devonian?). They showed a various range of morphologies which “prefigured” the diversity of the living crocodylians. They are not (directly) related to the crocodylians (phylogenetically), but they exhibit striking similar morphologies and adaptations. For instance, the stegocephalians (fossil amphibians) were mainly represented by aquatic or semi-aquatic carnivorous which reached giant sizes during the Mesozoic, up to 6 meters long. They also shared with the emerging crocodylians various evolving convergences, like a brevi-, a semi- or a longi-rostral cranial anatomy. These closed ecomorphological similarities between fossil amphibians and living crocodiles will be

presented in the context of their palaeoenvironmental history and evolution. It seems that ecological competitions with (amniotic) crocodylians probably led to extinctions of the major (non-amniotic) amphibians like the temnospondyls. The presence of an institution in France such as “La Ferme aux Crocodiles” of Pierrelatte is a great opportunity for European palaeontologists to observe extend crocodylians in order to dress ecomorphological comparisons with extinct taxa (i.e. without living representatives).

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Chemie der Erde

Permo-Carboniferous volcanism in late Variscan continental basins of the Bohemian Massif (Czech Republic): geochemical characteristic

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Abstract

Extensive Permo-Carboniferous volcanism has been documented from the Bohemian Massif. The late Carboniferous volcanic episode started at the Duckmantian–Bolsovian boundary and continued intermittently until Westphalian D to Stephanian B producing mainly felsic and more rarely mafic volcanics in the Central Bohemian and the Sudetic basins. During the early Permian volcanic episode, after the intra-Stephanian hiatus, additional large volumes of felsic and mafic volcanics were extruded in the Sudetic basins. The volcanics of both episodes range from entirely subalkaline (calc-alkaline to tholeiitic) of convergent plate margin-like type to transitional and alkaline of within-plate character. A possible common magma could not be identified among the Carboniferous and Permian primitive magmas, but a common geochemical signature (enrichment in Th, U, REE and depletion in Nb, Sr, P, Ti) in the volcanic series of both episodes was recognized. On the other hand, volcanics of both episodes differ in intensities of Nb, Sr and P depletion and also, in part, in their isotope signatures.

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Palaeogeography, Palaeoclimatology, Palaeoecology Volume 232, Issues 2-4 , 22 March 2006, Pages 190-213

The palaeoclimatology, palaeoecology and palaeoenvironmental analysis of mass extinction events

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Abstract

Although there is a continuum in magnitude of diversity loss between the smallest and largest biotic crisis, typically most authors refer to the largest five Phanerozoic events as “mass extinctions”. In the past 25 years the study of these mass extinction events has increased dramatically, with most focus being on the Cretaceous–Tertiary (K–T) event, although study of the end-Permian event (in terms of research output) is likely to surpass that of the K–T in the next few years. Many aspects of these events are still debated and there is no common cause or single set of climatic or environmental changes common to these five events, although all are associated with evidence for climatic change. The supposed extinction-causing environmental changes resulting from extraterrestrial impact are, at best, equivocal and are unlikely to have been of sufficient intensity or geographic extent to cause global extinction. The environmental consequences of rapid global warming (such as ocean stagnation, reduced upwelling and loss of surface productivity) are considered to have been particularly detrimental to the biosphere in the geological past. The first phase of the Late Ordovician event is clearly linked to rapid global cooling. Palaeoecological studies have demonstrated that feeding mechanism is a key trait that enhances survival chances, with selective detritivores and omnivores usually faring better than suspension feeders or grazers. This indicates that primary productivity collapse and consequent lack of food supply is a key proximate cause of extinction. Typically, this low productivity state continues for several hundred thousand years and is associated with widespread stunting of marine organisms (the Lilliput effect) and low-biomass ecosystems. Rebuilding of the marine ecosystem is an important process, and a number of models have been constructed that can be used for comparative purposes (e.g., to understand variation in rates of recovery between events, or between different regions within the same event). Understanding the extinction and recovery

processes in ancient events, especially those associated with global warming, may be crucial to managing the present biodiversity crisis. Yet, as many aspects of these mass extinction events remain little understood, there is still much work to do.

Keywords: Mass extinction; Ordovician; Devonian; Permian; Triassic; Cretaceous; Paleoecology

Review of Palaeobotany and Palynology Article in Press

Evidence for palaeo-wildfire in the Late Permian palaeotropics – charcoalified wood from the Um Irna Formation of Jordan

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Abstract

Charcoalified wood from the lower part of the Late Permian Um Irna Formation of Jordan is described. This charcoal represents the first evidence of palaeo-wildfire during the Late Permian in northern Gondwana. The source locality at the northeastern rim of the Dead Sea has yielded excellently preserved gymnosperm charcoal. Taxonomically most remains are identified as Dadoxylon-type gymnosperm wood. However, one woody specimen exhibits features that suggest a potential taxonomic relationship to the *Corystospermales*, a group otherwise represented at this locality by compressed fronds assigned to the genus *Dicroidium*. The occurrence of charcoal in the Um Irna Formation is in accordance with sedimentological data, as well as palaeoclimatic interpretations of this formation that suggest a tropical climate with alternating wet and dry seasons, favourable for the occurrence of wildfires. The charcoalified wood from the Late Permian of Jordan testifies for the first time to the occurrence of palaeo-wildfire in the low latitudes of northern Gondwana during this period.

Keywords: charcoal; fire; Late Permian; Jordan; northern Gondwana

Review of Palaeobotany and Palynology Article in Press

Extinction and recovery patterns of the vegetation across the Cretaceous–Palaeogene boundary — a tool for unravelling the causes of the end-Permian mass-extinction

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Abstract

High-resolution palynofloral signatures through the Cretaceous–Palaeogene boundary succession show several features in common with the Permian–Triassic transition but there are also important differences. Southern Hemisphere Cretaceous–Palaeogene successions, to date studied at high resolution only in New Zealand, reveal a diverse palynoflora abruptly replaced by fungi-dominated assemblages that are in turn succeeded by low diversity suites dominated by fern spores, then gymnosperm- and angiosperm-dominated palynofloras of equivalent diversity to those of the Late Cretaceous. This palynofloral signature is interpreted to represent instantaneous (days to months) destruction of diverse forest communities associated with the Chicxulub impact event. The pattern of palynofloral change suggests wholesale collapse of vascular plant communities and short-term proliferation of saprotrophs followed by relatively rapid successional recovery of pteridophyte and seed-plant communities. The Permian–Triassic transition records global devastation of gymnosperm-dominated forests in a short zone synchronous with one or more peaks of the fungal/algal palynomorph *Reduviasporonites*. This zone is typically succeeded by assemblages rich in lycophyte spores and/or acritarchs. Higher in the succession, these assemblages give way to diverse palynofloras dominated by new groups of gymnosperms. Although different plant families were involved in the mass-extinctions, the general pattern of extinction and recovery is consistent between both events. The major difference is the longer duration for each phase of the Triassic recovery vegetation compared to that of the Paleocene. The protracted extinction-recovery succession at the Permian–Triassic boundary is incompatible with an instantaneous causal mechanism such as an impact of a celestial body but is consistent with hypotheses invoking extended environmental perturbations through flood-basalt volcanism and release of methane from continental shelf sediments.

Keywords: Cretaceous–Palaeogene; mass-extinction; palaeobotany; palynology; Permian–Triassic; vegetation

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Palaeogeography, Palaeoclimatology, Palaeoecology Article in Press

The organic carbon isotopic and paleontological record across the Triassic–Jurassic boundary at the candidate GSSP section at Ferguson Hill, Muller Canyon, Nevada, USA

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Abstract

We present new litho-, bio-, and chemostratigraphic data from the Triassic–Jurassic (T–J) boundary section at Ferguson Hill (Muller Canyon), Nevada, USA. This section is a candidate for the base of the Hettangian Stage and thus the T–J boundary. Our measurements yield a 19 m thickness for the Muller Canyon Member of the Gabbs Formation. We recognize the Triassic–Jurassic boundary using the first appearance of *Agerchlamys*, and place it 9.6 m above the boundary between the Muller Canyon Member and the subjacent Mount Hyatt Member, with the first occurrence of the ammonite *Psiloceras tilmanni* occurring 0.9 m above this. Our organic carbon isotope record from this section shows two excursions toward lighter values, one at the T–J boundary, and the second in the lower parts of the Jurassic Sunrise Formation. These results are significantly different from a prior report on light stable isotopes from this section.

Keywords: Triassic; Jurassic; Carbon isotopes; Mass extinction

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Developmental patterns and ossification sequence in the Permo-Carboniferous temnospondyl *Archegosaurus decheni* (Saar-Nahe Basin, Germany)

FLORIAN WITZMANN

Summary

A size series of 143 specimens of the Permo-Carboniferous temnospondyl *Archegosaurus decheni* from the Saar-Nahe Basin (south-west Germany), ranging in size from 18 to 280 mm skull length, can be interpreted as an extensive growth series. This study focuses on the reconstruction of ossification sequences and developmental patterns of skull, visceral skeleton, and postcranium in *A. decheni*. With respect to the dermal skull, the ossification of the postcranium is delayed. The basibranchial starts to ossify after formation of the dermal pectoral girdle, sclerotic ring, stapes, scales, and scapulocoracoid. Initial ossification of the ischium takes place distinctly later than that of the ilium, and the pubis remains entirely cartilaginous. Vertebral centra ossify late, after formation of the ischium. Branchial dentition is resorbed at a skull length of 150 mm, indicating a long larval phase. Carpals and tarsals start to ossify only in the largest individuals. *Archegosaurus decheni* exhibits no period of obvious metamorphosis, as indicated by the dissociation of developmental events during ontogeny. The delayed formation of scales, scapulocoracoid, and basibranchial, in comparison with the Permo-Carboniferous temnospondyls *Sclerocephalus* and *Onchiodon*, may be correlated with the secondary aquatic adaptation of *A. decheni* throughout its life history. The chronology of ossification of the endocranial elements can be reconstructed. The exoccipital ossifies first, followed by the quadrate, basioccipital, basisphenoid, sphenethmoid, and otic capsule. Comparison with other anamniotic tetrapods shows that the early ossification of the exoccipital and quadrate is a stable pattern, and that there is a tendency to eliminate ossification of the basioccipital and basisphenoid.