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NEW EXCAVATIONS IN MARINE MIDDLE TRIASSIC FOSSIL-LAGERSTAETTEN AT MONTE SAN GIORGIO (CANTON TICINO, SOUTHERN SWITZERLAND) AND THE DUCAN MOUNTAINS NEAR DAVOS (CANTON GRAUBUENDEN, EASTERN SWITZERLAND)

The Lower Meride Limestones at Monte San Giorgio

The Meride Limestones from the Middle Triassic (Ladinan) sediments of Monte San Giorgio (Southern Alps in Canton Ticino) are 400 to 600 m thick and consist mainly of regulary bedded micritic limestones with thin marly interlayers (stratigraphy see Furrer 1995). They start about 150 m above the Grenzbitumenzone (=Besano Formation), famous for their rich fauna of reptiles and fishes, but also for their ammonoids and thin shelled bivalves of the Anisian-Ladinian boundary. The Meride Limestones are usually poor in fossils with exception of four vertebrate beds in the lower and uppermost part. From 1927 to 1933 B. Peyer (Zuerich University, PIMUZ) discovered in the lower Meride Limestones three fossil beds with numerous and well preserved specimens of the small pachypleurosaurid *Neusticosaurus*, a few specimens of the larger sauropterygian *Ceresiosaurus calcagnii* and one specimen of *Macrocnemus bassani*. Only a few actinopterygian fish and one echinoid had been reported. More fossils from the lower Meride Limestones were collected by paleontologists of Zuerich University in the years 1937-38 and 1971-75 (for references see Kuhn-Schnyder 1974; Furrer 1995). After Sander (1989) the three beds are characterized by different pachypleurosaur species: The Cava inferiore beds with *Neusticosaurus pusillus*, the Cava superiore beds with *Neusticosaurus peyeri* and the Cassina beds with *Neusticosaurus edwardsii*. From the uppermost part of the Meride Limestones, the Kalkschieferzone, actinopterygian fishes had been reported first by Wirz (1945). Later, three specimens of aquatic reptiles (*Lariosaurus lavizzarii* and *L. valceresii*) and many small actinopterygians have been found in fossiliferous beds of the Kalkschieferzone on Swiss and Italian territories (Tintori 1990; Renesto 1993).

Based on the compiled field data, a taphonomic and palecological study on the material from the older excavations, stored in the collection of the PIMUZ is in progress. Unfortunately, no documentations on the detailed stratigraphy of Peyer's excavations are known. To fill this lack, some small excavations were organized by H. Furrer from the PIMUZ in collaboration with M. Felber from the Museo Cantonale di Storia Naturale di Lugano. The first one started 1994 in the Kalkschieferzone in the valley of the river Gaggiolo West of Meride. Their stratigraphy, taphonomy and palecological interpretation have been published by Furrer (1995). Eight species of actinopterygian fishes were described by Bürgin (1995). In 1997 A. Tintori and C. Lombardo (Milano University) started a new excavation in the lower Kalkschieferzone near Meride (see this volume). In 1995 and 1996, we made two careful bed by bed studies on a surface of about 10 m2 in the Cava inferiore beds at the locality Acqua del Ghiffo near Crocifisso. These beds

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consisting of black shales, fine laminated limestones and dolomites is only 1.50 m thick and interbedded with a lower and upper volcaniclastic layer of 4 and 3 m thickness respectively. Together with a new juvenile specimen of *Ceresiosaurus calcagnii* (Hänni, in prep.) we found almost 100 fragmentary or complete skeletons of *Neusticosaurus pusillus*, mainly adult specimens of 30-40 cm length, but also rare juvenil ones. The new fish material (40 specimens of 8 species) will be described by T. Bürgin (this volume). For the first time a small *Legnonotus* was found to display in his stomach content about 50 ostracods. Clumpy concentrations of these small crustaceans on many bedding planes are interpreted as regurgitations of fishes. These ostracods probably lived in the shallow water of the surrounding carbonate platform, that probably was also the biotop of the crustacean *Halicyne*, the serpulid *Spirorbis*, bivalves, gastropods, lingulid brachiopods and the common dasycladaceen algae, brought into the basinal sediments by storms and currents. In 1997 we began a similar excavation in the some 20 m higher Cava superiore beds, a 10 m thick interval of very fine laminated bituminuous limestones and shales, only interrupted by rare micritic limestones, displaying sometimes conglomerates or normal graded calcarenites at the base. Autochthonous animals are the small pachypleurosaurid *Neusticosaurus peyeri*, the larger sauropterygian *Ceresiosaurus calcagnii* and very rare actinopterygians as *Saurichthys* sp. and *Besania micrognathus*. Rare finds of small gastropods, *Spirorbis*, *Halicyne* and land plants (*Voltzia* and *Equisetites*) seem to have been washed into the basin by storms.

The biostratigraphic data are poor. Wirz (1945) reported from the lowermost Meride Limestone a fossiliferous bed with *Daonella moussoni* and "*Trachyceras archelaus*", revised by H. Rieber as *Protrachyceras* cf. *ladinum*.. About 40 m above, in the Cava superiore beds, we collected 1998 some specimens of *Arpadites* cf. *arpadis* (determination H. Rieber). Both ammonoid species occur in better dated sections of Eastern Lombardy and the Western/Central Dolomites in the the *gredleri* Zone of the Early Ladinian (Brack, Rieber & Urlichs, in print).

The work is still going on and will be shown during the field trip of September 5 1999.

The Prosanto Formation near Davos

Since 1976 more than 1000 small but well preserved actinopterygian fishes, a few reptiles and some crustaceans, bivalves, gastropods, dasycladacean algae and terrestrial plants have been collected from the Ladinian Prosanto Formation in the Ducan and Landwasser region near Davos (Austroalpine in Canton Graubünden). The sequence of dark limestone, shale and dolomite of the Prosanto Formation occurs as a 100 to 200 m thick and more than 20 km wide lenticular intercalation in shallow water dolomites (Vallatscha and Altein Formations) of the strongly deformed sediments of the Austroalpine Silvretta Nappe. A paper on the geology, stratigraphy, paleoecology and the fossils was published by Bürgin et al. (1991). As most of these fossils were collected in the scree, small excavations have been organized in 1992/93 and 1997/98 in two alpine localities near Davos to obtain more information about the taphonomy of the fossils and their distribution within the layers. Fossiliferous beds of 2 to 3 m thickness were studied in detail on a surface of 10 square meters, yielding about 500 complete or fragmentary fossils, mainly actinopterygian fishes.

The ichthyofauna is being studied by A. Herzog (Zürich) under the direction of T. Bürgin (St. Gallen). A preliminary list of 16 species can be compared with the Monte San Giorgio fauna. Articulated skeletons of the aquatic pachypleurosaur *Neusticosaurus*, fragmentary rests of larger sauropterygians and the terrestrial protorosaur *Macrocnemus* are rare. A few benthic fossils, such as crustaceans (*Antrimpos, Schimperella, Halicyne, Atropicaris*), echinoids, inarticulated brachiopods (*Lingula*), bivalves and gastropods probably were washed into the basin by storms and superficial currents, together with the common dasycladacean algaes. These organisms lived in the shallow water of the adjoining carbonate platforms, documented by the dolomitic Vallatscha Formation. The presence of terrestrial areas is indicated by branches of the conifer *Voltzia* and partly silicified wood (*Araucarioxylon*).

Taphonomy, paleoecology and paleogeography of these Fossil-Lagerstaetten

The fossil beds in the Lower Meride Limestones and the Prosanto Formation are very similiar. Articulated skeletons of actinopterygian fishes, aquatic reptiles and crustaceans, coprolites and branches of conifers have been preserved only in finely laminated limestone, marl and shale beds without any bioturbation. Bedding planes with filaments up to 5 mm in length and 0.2 mm diameter are supposed to be compacted mats of sulphur bacterias, comparable with the Recent *Thioplaca* mats in the oxygen-minimum zone along the contintal shelf off Peru and Chile (Fossing et al. 1995). There are no signs of current activity such as orientation of skeletons or unidirectional drifting of finer skeletal elements, in these background sediments. Some fragmentary skeletons and many isolated skeletal elements of reptiles and fish suggest a slow settling and decay of some carcasses through the water column. Slumps, conglomerates and calcareous turbidites, often rich in siliceous sponge spicules, ostracods and benthic foraminifers, document the instability of the basin margins. A few beds with trace fossils (*Thalassinoides* and *Rhizocorallium*) document short events of bottom population by deposit feeders, probably linked to gravity flows, transporting burrowing organisms and oxygen into the normally anoxic environment. The small fishes *Habroichthys* and *Placopleurus* presumably lived in large schools feeding on planktonic organisms. Other actinopterygian fishes preyed on small hard-shelled organisms, partly attached to hard substrates or algae in the shallows of the surrounding carbonate platforms. Small and large predatory fishes (*Saurichthys* and *Birgeria*) were in competition with the small pachypleurosaurs and the larger sauropterygians.

These fossil beds are typical conservation deposits, controled by stagnation, obrution and bacterial sealing. The characteristic finely laminated limestones, marls and shales must have formed in a small basin below storm wave base. The extraordinary fossil preservation and lack of bioturbation can be explained by inhospitable bottom water, which excluded any living macrobenthos. The rare finds of macrobenthos, such as crustaceans, echinoids, inarticulate brachiopods, bivalves, gastropods and the numerous dasycladacean algae, probably were washed into the basin by storms and superficial currents. These organisms lived in the shallow water of the adjoining carbonate platforms, documented by the Salvatore Dolomite or Esino Limestone in the Southern Alps or the Vallatscha Dolomite in the Austroalpine. The presence of terrestrial areas is indicated by fossils of terrestrial

plants and the protorosaur *Macrocnemus*. The rarity of stenohaline organisms, such as cephalopods, articulated brachiopods and echinoderms, indicate a restricted environment. The only connection to the open sea probably existed through the shallow water on and channels between the carbonate platforms. Intense evaporation possibly led to increased salinity and formation of a pycnocline by concentration of the dense brine in the deeper parts of the restricted basin. Stagnant hypersaline bottom water and depletion of oxygen by decaying organic matter could explain the abiotic environment. Both formations were deposited in similiar intraplatform basins separated by shallow carbonate platforms from the open ocean of the Triassic Tethys.

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