

comparable with inarticulate brachiopods. Not only are the latter composed of calcium phosphate but the protegula (= larval shells) of acrotretids show cross-cutting and discrete circular pits that have been interpreted to be the result of internal resorption. The formation of circular resorption pits in juvenile acrotretid brachiopods would have permitted them to retain a covering of calcium phosphate that was strong on one hand but light and porous on the other, and would have permitted the juvenile acrotretid brachiopod to remain afloat before being ready to settle down. Resorption of calcium phosphate in the possibly related conodontophorids may have served a similar purpose.

Conodont Faunas from Devonian and Carboniferous Conglomerates of the Western Mediterranean and their Paleogeographic Implications.

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Limestone boulders of conglomerate horizons from 3 localities on the island of Menorca (Balears) and 3 localities in the Betic Cordillera (Southern Spain) yielded conodonts of mostly excellent preservation. The specimens from Ferragut Vell and Escollo del Frances (northern Menorca) throughout indicate an age of Upper Devonian I, those from Cala Murta (east coast of Menorca) show a temporal distribution from Upper Devonian I to lowermost Namurian. At Velez Rubio (near Murcia) in the eastern Betic Cordillera the „Polymict Conglomerate Member“ yielded conodonts of Givetian, Upper Devonian and Lower Carboniferous ages. A second clastic horizon, the „Marbella Conglomerate Member“, could be dated Upper Viséan to Lower Westphalian. At La Peluca and at Ardales (NW of Malaga) conglomerate layers show the same age as the Marbella Conglomerate.

The rich microfauna of the Upper Devonian I samples from Menorca allow the establishment of a paleoenvironmental model for a differentiated carbonate shelf. A comparison of the distribution of different groups of conodonts and other microfossils with the various microfacies types shows a remarkable correspondence. Apart from indications by typical environmental index microfossils some obvious trends can be noticed with the conodonts: maxima of icriodontiform elements from the outer shelf to the lower shelf slope and at subtidal ridges; maxima of palmatolepiform elements at subtidal ridges; minima of polygnathiform elements at the back-reef, at the outer shelf, and at subtidal ridges; maxima of ramiform elements in lagoons and at the back-reef. — The faunas contain 3 new species of the genera *Bisphathodus*, *Caenodontus* and *Falcodus*.

The conglomerates are interpreted as deep-sea deposits within submarine canyons. A reconstruction of the paleogeographic setting permits to postulate the existence of a pre-Variscan continental margin of the Atlantic type which included the North African Meseta, the Moroccan Variscan orogenic belt and the Alboran-Balearic flysch trough. The source area of the Devonian boulders is probably the Moroccan Variscan orogenic belt.

The Value of Icriodontidae in Stratigraphic Correlation.

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Refinement of systematics of Icriodontidae in the late 1960's and early 1970's supported the idea that this group could be used in Devonian biostratigraphy as successfully as most of the Polygnathidae. Since that time most conodont research has dealt with biofacies and paleoecology and on the whole the Icriodontidae are now considered to have been particularly adapted to shallow water shelf environment whereas many Polygnathidae had a deeper, pelagic habitat. Consequently, the stratigraphic value of Icriodontidae, especially in intercontinental correlations is strongly questioned because of this biofacies generalisation and on the base of more concrete and more local observations as in the following quotations: „highly irregular vertical distribution of *Icriodus* in most sequences“, „*Icriodus* and other Icriodontids, which developed endemic species . . . were probably not capable of distribution and survival via major oceanic currents“. More definite is the very recent opinion that in the Middle Devonian *Icriodus* is extremely dependent on local facies factors („ecophenotypic groups“). As a partial alternative to these hypotheses attention is drawn to the fact that in the late Lower Devonian, the Middle Devon-

ian, and the early Upper Devonian some *Icriodus* species such as *I. fusiformis*, *I. culicellus*, *I. rectirostratus*, *I. retrodepressus*, *I. regularicrescens*, *I. obliquimarginatus* and *I. subterminus* have a wide or sometimes nearly cosmopolite dispersion in different magnafacies areas (type Ardenno-Rhenish and Hercynian-Bohemian) and there is no marked difference in the earliest occurrence of each species. This means that the geographical dispersion of at least some *Icriodus* species was due primarily to good communication seaways which could be modified in the course of time and not to very specialised local facies factors. Having in mind the SEDDON and SWEET model for conodonts, the dominance of *Icriodus* in shallow water shelf environment implies no restriction in geographical dispersion. Particularly in this environment, anomalies in the vertical distribution of *Polygnathus* taxa, e. g., *P. serotinus*, *P. linguiformis* div. subspecies, *P. cooperi cooperi* can be noticed.

Reexamination of Late Pennsylvanian and Early Permian Conodont Apparatuses Using Clustering Techniques.

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Conodont faunas containing easily identified Pa elements assignable to the genera *Diplognathodus* and *Hindeodus* have been reported from Upper Pennsylvanian and Lower Permian strata of North America. If the seximembrate model for the apparatus of each genus is correct, the remaining elements should also be present. However, previous investigators have normally considered ramiform elements which might be assignable to the two genera as attributable to species of either the *Idiognathodus*–*Streptognathodus* plexus or *Adetognathus*. It is suggested that the ramiform elements reported from the uppermost Pennsylvanian and lowermost Permian are more likely related to the Pa elements of *Diplognathodus* and *Hindeodus* than to the previously accepted association with the Pa elements of the *Idiognathodus*–*Streptognathodus* plexus and *Adetognathus*.

Three data sets obtained from the literature were analyzed using a number of different similarity measures, clustering procedures and data transformations in order to examine various aspects of the faunas. The results of the different cluster analyses maintained remarkable consistency both within and between the three data sets and provide an interpretative outline. The results are interpreted as supporting the association of the various ramiform with *Diplognathodus* and *Hindeodus* rather than with *Idiognathodus*–*Streptognathodus* and *Adetognathus*. This satisfies the apparatus structure of *Diplognathodus* and *Hindeodus*, but opens the question of the Late Pennsylvanian and Early Permian apparatus structure of *Idiognathodus*–*Streptognathodus* and *Adetognathus*.

Extinction of Triassic Conodonts.

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There is some agreement that extinction of higher taxa is one of the expected, even predictable results of evolution and not the result of inadequacies shared by all species of a group. This view is in contrast to ideas that higher taxa extinctions might be explained by a catastrophic, „across the board“ related cause.

The extinction of conodonts is an event that can be used to test different extinction models. For example, if diversity of species population size decreased, conodonts would be subjected to localized extinctions due to random fluctuations in environmental conditions and inability to recolonize. This should be identifiable in the rocks. Alternately, if there were adverse environmental factors that affected the conodont life style and caused extinction of the entire group, sedimentary petrology of the rocks in which this occurred might give some signal.

The Upper Triassic-Lower Jurassic rocks of western North America and Austria apparently bear normal marine faunas and have no significant unconformity. In Austria, 19 conodont form-species were progressively reduced by extinction during the Norian. Some 7 species reportedly evolved during the Norian-Rhaetian interval and 4 survived until near the close of the Rhaetian. In North America, only 5 species are present during the Norian. Two of the North American species survived until late Norian but became extinct prior to the Rhaetian. Carbonate sequences indicate that there were minor envi-

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

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