Conodont Biostratigraphy of the British Silurian.

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In his highly influential paper on Silurian conodonts, WALLISER (1964) proposed a conodont zonation of the Silurian, based mainly on material from the Carnic Alps. Subsequent work in other parts of the world has established the widespread distribution of some of the key species, but the complete sequence of zones has not been recognized elsewhere. In Britain, for example, only the *celloni, amorphognathoides, sagitta* and *eosteinhornensis*-Zones have been identified by the occurrence of the index species. Consequently, several local zonal schemes have been introduced in different parts of the world and a widely applicable zonation seems a distant prospect.

Condonts do, however, show considerable promise for international correlation in the Silurian, and the distribution of species in reference successions should be fully documented. Of particular importance are the classic sections of Britain, especially in the type areas of the Llandovery, Wenlock and Ludlow Series. Low abundances in parts of the succession and environmental variation in others mean that a British zonal scheme is probably inoperable, but the datum plane approach of COOPER (1980) offers a possible solution. Although only four of his eight selected events are recognised in Britain, several additional species would certainly prove useful. However, datum planes correlate only biological events, which may well be diachronous; a scheme based not on conodonts alone but on whole biotas may, in the end, provide the best basis for stratigraphy.

Dinantian Conodont Studies in the British Isles 1969–1979.

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The past decade has seen a dramatic increase in the number of publications devoted to the recording and description of Dinantian conodonts from the British Isles. A faunal zonation requires an established reference section of rocks. The reference section for Dinantian rocks in Britain at the commencement of the decade was the sequence exposed in the Avon gorge at Bristol, described by VAUGHAN in 1905. In 1969 RHODES, AUSTIN and DRUCE published a description of conodonts which included elements recorded from the type section at Bristol. Subsequently conodont faunas were described by research workers who had studied Dinantian sequences in many parts of Britain and Ireland. Gradually sequences of conodont faunas were recognised which differed in different parts of the region. These differences were attributed in part to differences in the environments of deposition of the Dinantian sediments. An initial attempt was made to reconstruct the apparatuses of Dinantian conodont bearing organisms. In 1976 a working party of the Geological Society of London proposed a new set of stratotype sections comprising six stages. In recent years conodont faunas characteristic of these stages have been reported, although unfortunately some of the stratotype sections have yielded poor faunas. The Dinantian conodont biostratigraphy in Britain is at present poorly defined. The appearance of diagnostic and often exotic forms has been used in the past for the recognition of what may well represent facies faunas. Recent studies have been devoted to the systematic investigation of genera which exhibit relatively slow evolutionary changes. A refined zonation can be adopted by application of statistical techniques to successive conodont populations. It is anticipated that in the future the boundaries of the regional stratotypes will be recognised by the selection of a quantitative value for a particular conodont biocharacter within an evolving population and that this method will also be used to correlate Dinantian strata in different parts of the region.

Comparison of Conodont- and Ammonoid-Based Correlation of the Mississippian-Pennsylvanian Boundary in North America with the Namurian of Europe.

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Correlation of Late Mississippian-Early Pennsylvanian strata in North America with their European

Namurian counterparts has been based on ammonoid sequences in Arkansas and the British Isles, even though the two successions have no ammonoid species in common. Traditionally, the Arkansas ammonoid succession has been interpreted to be less complete than the one in Britain, having a major break at the Mississippian-Pennsylvanian contact that includes the Chokierian and Alportian Stages. This interpretation places the base of the Pennsylvanian in Arkansas at or near the base of the Kinderscoutian Stage.

Incorporation of known conodont occurrences into this framework of ammonoid-based correlations would require different ranges for certain conodont species common to both North America and Europe. For example, it requires the oldest occurrence of *Neognathodus symmetricus* in Europe to correlate with the base of the Pennsylvanian, which is a much earlier occurrence than is known for that species in North America. *Rhachistognathus primus* and *R. muricatus,* important in the North American zonation, have not been found in Europe – the assumption being they were geographically restricted to North America.

In contrast, these differences in the North American and European conodont ranges and faunas vanish if the European succession is interpreted to have a major hiatus separating the Arnsbergian and Chokierian. This hiatus is equivalent in North America to at least part of the Late Mississippian *unicornis*-Zone, as well as the *muricatus*-Zone, the Early Pennsylvanian *primus*-Zone and part or all of the *sinuatus*-Zone. Our studies of the conodont genera *Rhachistognathus, Declinognathodus, Idiognathoides,* and *Neognathodus* show that *R. minutus,* a cryptogen that appears at the base of the Chokierian in Europe, first appears in a phyletic sequence near the top of the *primus*-Zone in North America. Palynologic information from both regions reinforces our conclusion.

The Early Days of Conodont Research in Europe.

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Conodont Color Alteration as Indicator of Incipient Metamorphism in Ordovician Rocks in Scandinavia and the British Isles.

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For several years, the temperature-induced color alteration of conodonts has been used for assessment of the degree of heating of Paleozoic and Triassic rocks regionally and locally in North America but no regional studies of this type have been reported from Europe. Based on conodont collections from 87 Ordovician sections in Scandinavia and 33 in the British Isles, an attempt is made to evaluate the local and regional patterns in the degree of heating in these areas, and interpret the paleogeothermal conditions in terms of events in the local geologic history. All studied samples from areas without intrusives on the Baltic Platform, also including those from the Siljan astrobleme in central Sweden, suggest maximum heating temperatures below 90°C. Areas with intrusives in southern Sweden (Skåne, Västergötland) show a wide range of Color Alteration Index (CAI) values (1–7) indicating heating temperatures ranging up to more than 300°C locally. At several localities, one can study how the degree of heating is related directly to the distance to the intrusive. Autochthonous rocks in the Province of Jämtland in northern Sweden have been heated to more than 110°C, and in some cases to more than 300°C. Samples from the nappes in Jämtland, the Oslo region in Norway, and the Trondheim region in the central Norwegian Caledonides all suggest heating to more than 300°C. In the British Isles, the available collections from Wales, Ireland, the Lake District, and most of southern Scotland indicate, with one possible exception, heating to more than 300°C. In contrast, the conodonts from the Caradocian type area in Welsh Borderland, and the Girvan area in southwestern Scotland, show virtually no thermal metamorphism. In general, the CAI indications are in excellent agreement with other evidence pertaining to the paleogeothermal history of the areas studied but the lack of substantial heating of the Ordovician rocks of the Girvan area is a puzzling problem. The semiquantitative temperature data obtained through CAI studies not only provide useful information about the geothermal history but also, they may be