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

used as a guide to suitable areas for studies using K-Ar, fission-track, paleomagnetic, and other methods in which secondary heating, if high enough, may introduce serious errors in the results.

Conodont Biostratigraphy in Carboniferous Limestones of Southern France.

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Conodont biostratigraphy in southern France provides a basis for correlation of Carboniferous rocks from three regions: the central and western Pyrenees, the Mouthoumet massif and the southern slope of Montagne Noire.

In the Pyrenees, a detailed biostratigraphic zonation has been established which includes, from oldest to youngest, the following lithologies: limestone, including nodular limestone (zones Tn1a–Tn2a); chert with phosphatic nodules (zones Tn2–V1); gray micritic limestone (zones Tn3–V3b); variegated limestones with nodular structures (zones V3c–E2); and micritic limestones that are laminated near the top and are locally associated with tongues of breccia (zones H1–R). These units are of variable thickness. The rocks are everywhere overlain by a thick section („Culm") of pelitic sandstone of Namuro-Westphalian age.

The following conodont zones (oldest to youngest) are erected for the Carboniferous rocks in the Pyrenees: *Siphonodella sulcata – Protognathodus kockeli; Siphonodella – Pseudopolygnathus triangulus triangulus, Polygnathus communis carina, Gnathodus semiglaber, Dollymae bouckaerti, Scaliognathus anchoralis, G. homopunctatus, G. commutatus – G. bilineatus, G. bilineatus – G. nodosus, G. bilineatus – G. bil. bollandensis, Idiognathoides noduliferus, I. sinuatus, I. sulcatus* cf. *parvus.*

The western part of the Mouthoumet massif (relative authochthon) includes the following stratigraphic section (from oldest to youngest): micritic limestones, commonly nodular (zone Tn1a); black chert with phosphatic nodules (zones Tn2a–Tn3); and bluish-gray to pale gray well bedded limestone, becoming more argillaceous towards the top and commonly including cinerites and green chert (zones Tn3c–V3c); a detrital series locally containing Goniatites („Mondette" fauna) typical of the Viséan-Namurian transition. The following conodont zones are recognized: *Sc. anchoralis, G. homopunctatus, G. commutatus – G. bilineatus, G. bilineatus – G. nodosus, G. bilineatus – G. bil. bollandensis.*

Five lithologic units are exposed in overturned limbs of nappes on the southern slope of Montagne Noire and represent the entire Dinantian. From oldest to youngest these units are as follows: nodular limestones („supragriottes") (zones Tn1a–Tn1b); chert with phosphatic nodules (zones Tn2b–Tn3c); intermediate nodular limestones (zones Tn3c–V1a); light-colored cherts, turbidites and calcareous breccias (zones V1b–V3b); and a flysch series, with calcareous olistostromes, younger than zone V3b. The Dinantian in the olistostromes differs from the Dinantian rocks in the nappes by the presence of oolitic and bioclastic limestones, occasionally with graded beds; limestones with flint or chert layers; beds of nodular marly limestone containing Cephalopods and trails; limestone reefs; and local unconformities (upper Tournaisian limestones overlying with hard ground various units of Famennian age).

The conodont zones characteristic in the Pyrenees are poorly represented in the Montagne Noire region. The zones present are: *Sc. anchoralis* and *G. commutatus.* The *Pr. kockeli, Siphonodella – Ps. triangulus triangulus,* and *G. commutatus – G. bilineatus* Zones are rarely present, and the others present in the Pyrenees have not been recognized.

From these observations, it appears that the Tournaisian zones are not everywhere systematically present. The oldest beds contain the *Sc. anchoralis*-Zone. These beds occasionally are transgressive upon various Devonian rock units. In regard to the Viséan, the *G. homopunctatus*-Zone is practically present in all of the areas studied. The *G. bilineatus – G. nodosus* and *G. bilineatus – G. bil. bollandensis*-Zones are missing in the Montagne Noire region, present in the Mouthoumet massif and well developed and overlain by the *Idiognathoides*-Zones in the Pyrenees.

The deposition of flysch lithologies seems to have begun earlier in Montagne Noire (zones V3b–V3c) than in the Mouthoumet massif (zones 3Vc–E1), and they appear still later (H or R zone) in the western Pyrenees. Farther to the west, e. g., Asturias, northwestern Spain, flysch deposits first appear from Namurian A (Serpukhovian, E2) to Namurian B (Bashkirian, R).

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