Montpellier, France, July 4-8, 1989

Report on the symposium

The increasing interest of geologists in nonmarine sediments has revealed in the last 20 years the importance of charophyte algae in the stratigraphy and correlation of freshwater and brackish deposits. The charophyte calcified fructifications (gyrogonites) that are preserved as fossils are present in carbonate sediments dating from the Late Silucian to Holoceme. These gyrogonites undergo phylogenetical changes that, in certain periods, are of short duration and thus provide a tool for precise biostratigraphical dating. Some species, widely distributed, are useful in distant correlations. Further advantages of gyrogonites are their small size (diameter ranging from 0,2 to 2 mm) and the fact that they are found frequently in abundance and can be recovered from borehole material.

Because of the large amount of information that has been collected on 100 charophyte genera, specialists from around the world have needed to gather in order to discuss evolutionary processes, compare biozonations, and debate the significance of paleoenvironments. The first such meeting of specialists in both extant and fossil charophytes was held in Montpellier, France, in July 1989. Sponsored by the International Palaeontological Association and by the International Geological Correlation Programme's project on biological events in Earth history, the meeting drew 60 participants from 15 different countries. A total of 54 communications were presented as lectures or poster sessions, änd they covered a wide scope of biological and paleontological studies.

One major theme of the symposium was biostratigraphy. New results presented on the Mesozoic and Tertiary charophyte floras of Asia (India, Republic of Korea, PRC), South America (Argentina), and Europe (France, Spain, Switzeriand) showed that the different zonations determined so far for each of the separate land masses can be correlated, in some cases, by means of cosmopolitan or widely distributed forms. Examples include Atopochara trivolovis triquetra (early Barremian), the species of Platychara at the Cretaceous-Tertiary boundary, and Maedleriella monolifera in the early Eocene. Of great importance is the integration of the charophyte zonation into the standard cominental (ostracode-, palynoflora-. mammal-based) zonations and, as far as possible, marine (ammonoid-, foraminifer-, or calpionellid-based) zonations.

Marine-continental correlations provide information on the evolution of sedimentary basins, as was illustrated by lectures reporting on Early Cretaceous floras from Spain and Switzerland. Several contributions, including the comparison of charophyte studies with data from other fossil groups and comparison with radiometric and paleomagnetic data, all focused on the Cretaceous-Tertiary boundary, in particular the dating of the Infra-Trappean Beds of the Godävari area (southwest India). These beds appear likely to be of Danian age. If confirmed by further research. this discovery would be of great importance in dating the Deccan Traps volcanism, which is thought to be at the origin of the Cretaceous-Tertiary boundary crisis. The duration of the charophyte zones varies according to

their age. The average duration of each zone is thought to be 5.5 m.y. for the BerriasianCenomanian interval and 1.6-1.7 m.y. for the Late Cretaceous (late Campanian / Maastrichtian) and Paleogene Periods.

Charophyte ecology and paleoecology are gaining interest. The influence of latitude, climate, altitude, water depth, and salinity on the distribution of living species drew special attention. The position of charophyte populations within limnic ecosystems was also a subject of discussion. Charophytes are pioneers in the colonization of new ecological niches. As demonstrated by research on the Scanian lakes in Sweden, charophytes are particularly sensitive to lake eutrophication as a result of chemical pollution and drainage of lakes and ponds. The distribution patterns of living species can be extrapolated, in some cases, to fossil species. Thus, a Holocene thanatocoenosis consisting of the unusual association of Chara species with marine formaminifers and mollusks, found in a coastal saline lake in Languedoc in the south of France, resulted from periodic incursions of the sea. This example could be used to support the perhaps-rash interpretation that ancient charophyte environments were, therefore, marine habitats. An example of a semiprotected, open-marine oligohaline habitat containing Sycidium was presented from the Devonian carbonate complexes of southern Potand. In this case, however, the environmental conditions differed only slightly from the usual environment of charophyte species, which grow where sheltered from violent waves and currents. The oldest charophyte assemblage described from the Upper Silurian deposits of Podolia (USSR) has been found in Pridoli deposits together with terrestrial plants (notably, the first vascular plant Cooksonia), apparently a nonmarine environment.

The use of stable oxygen and carbon isotopes of gyrogonites as indicators of paleoclimatic variations during the Oligocene/Miocene transition is a new avenue of research. Data presented on the calcified wall and oospore membrane also constitute a potential for future investigations, particularly concerning the relationship between extant and fossil gyrogonites.

Several lectures focused on phylogeny and evolutionary processes. Polymorphism resulting from environmental variations, which has been observed in some of the Porocharaceans from the Swiss Berriasian, is found also in living species, where it appears to correspond not to genetic differentiation but to ecotypic variation. This has been demonstrated by using electrophoresis, applied recently to the study of charophytes for the first time. An example of fossil evidence that provides possible clues to the present and future was given by the cycle extinction-crisis-speciation, a cycle demonstrated by a multidisciplinary study of the Cretaceous-Tertiary boundary in the western Mediterranean area.

Two excursions in the south of France followed the charophyte symposium. One excursion to the Camargue Natural Park took participants along coastal saline lakes and freshwater paddy fields containing living characean species. The other excursion presented participants the opportunity to collect abundant. well-preserved fossil specimens first in the Upper Cretaceous-Paleocene sequences of the Villeveyrac basin and second in a succession of brackish and lacustrine sediments of lower Eocene age in the Aude valley and Minervois.

The numerous collaborations inspired by the charophyte symposium prove the value of such a meeting. The creation of an International Research Group of Charophyte Specialists and the publishing of a review, the IRGC News, will facilitate contact among charophyte researchers. The second symposium is planned for 1992 and will take place in Nanjing, PRC. Contributions from the charophyte symposium will be published in a future issue of the Bulletin de la Societe Botanique de France.

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