Algal Cysts from the Late Cretaceous of Gippsland Basin.

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Introduction

The field of palynology is reviewed in terms of its contributions to angiosperm systematics and phylogeny. Principal pollen characters which are phylogenetically useful at higher taxonomic levels (including aperture type, pollen wall architecture, pollen-unit, polarity, symmetry, shape, and grain size), and their evolutionary trends are examined. Many palynological characters and concepts are subjected to re-examination, particularly in an evolutionary-phylogenetic context. An attempt is made to show how pollen characters correlate with various higher categories of the Takhtajan and Cronquist systems of angiosperm classification and to outline certain phylogenetic tends observed in the pollen of different groups of angiosperms. With some exceptions, pollen morphology is consistent with the levels of relative advancement and the relationships postulated in the Takhtajan and Cronquist systems. Angiosperm pollen grains are clearly divisible into two fundamentally different types (each with its own derivatives): heteropolar, bilateral, boat-shaped monosulcate pollen versus isopolar, radiosymmetric, globose tricolpate pollen.

"Gymnospermous" monosulcate pollen and derivative types (ulcerate, disulculate, etc) characterize both the putatively primitive dicotyledonous subclass Magnoliidae and the monocotyledons. The six non-magnoliid dicotyledonous subclasses, on the other hand, are characterized by tricolpate pollen and derivative types (tricolporate, triporate, rugate etc.). Relatively primitive tricolpate pollen is retained by many Ranunculidae, Caryophyllidae, and "lower' Hamamelididae. The Dilleniidae (except Dilleniaceae) and Rosidae are somewhat more advanced in having basically compound-aperturate tricolporate pollen. The subclass Asteridae, which retains indications of a rosid ancestry, exhibits the greatest array of specialized pollen types. The most important palynological contradiction of the Takhtajan and Cronquist systems is the fact that the highly specialized, basically triporate pollen of the "higher" Hamamelididae (Amentiferae) can be more directly related to triangular tricolporate pollen of the Rosidae than to the tricolpate pollen of the "lower" Hamamelididae. Briefer sections of the paper deal with pollen technique and the major reference works of systematic palynology. In the northern hemisphere, many palynological studies have been made of changes in vegetation occurring since the continental-scale glaciers melted back, beginning about 12-15 thousand years ago. A commonly observed pattern from the pollen record is that the oldest samples, representing recently deglaciated times, indicate plant species that are now typical of northern tundra, while somewhat younger samples suggest a boreal forest of spruces, fir, and birch

Palynology is the microscopic study of fossil spores and pollens. Because plants evolved through time, and climates changed through time, the plants in coal-forming wetlands changed through time. In many coal basins, groups of coals, and sometimes individual coals, can be correlated based on their spore and pollen content. Vertical and lateral changes in palynology are sometimes good indicators of likely changes in coal quality because they relate to the original coal-forming swamp plants and swamp conditions. Palynology can be used to determine what the ancient coal-forming wetlands that formed the coal looked like for comparison to modern peat-forming wetlands.

Pollen consists of microscopic grains containing the male gametophyte of coniferous (cone-bearing) and angiosperm plants. Pollen of most species of plants undergoes a long-distance dispersal from the parent plant, so that fertilization can occur among individuals (instead of self-fertilization). A plant spore is a kind of reproductive grain capable of developing as a new individual, either directly or after fusion with another germinated spore, such as the kind produced by ferns, horsetails, and club-mosses. Spores with simpler functions are produced by mosses, liverworts, algae, fungi, and other less complex organisms.

Plant species in the pollen record of lake sediment and peat are not represented in the same relative abundance they are in the nearby vegetation. Wind-pollinated plant species are most abundant, because these plants release huge amounts of pollen into the environment. For example, many species of pines, which are wind pollinated, are so prolific that during their flowering season a yellow froth of pollen may occur along the edges of lakes and ponds. Insect-pollinated plant species are more rare. The great differences in pollen production among plant species must be taken into account when interpreting the likely character of local vegetation on the basis of the fossil-pollen..

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