



Tectonics of the Southeastern Tibetan Plateau and Its Adjacent Foreland

By B.C. Burchfiel and Chen Zhiliang

This volume and its four accompanying plates provide a comprehensive overview of 14 tectonic units in eastern and southeastern Tibet and its foreland.



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Plant Macrofossils from Kirchner Marsh, Minnesota—A Paleoeological Study

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Abstract

Seeds and other plant macrofossils were extracted from cores used previously for pollen analysis, and the results are presented in the style of pollen diagrams.

The Zone A macroflora is characterized by abundant *Picea* (spruce) and *Larix* (tamarack) needles. The remaining species are widely distributed on swampy lake shores, in silty lakes, or in forest-floor communities. The macroflora contains no arctic element and confirms an earlier view that it is analogous to the present-day Boreal Forest in southern Manitoba.

In Zone B macrofossils of *Betula papyrifera* (paper birch) and *Abies balsamea* (fir) replace *Picea* and *Larix*. Aquatic plants suggest a lake with a well-developed reed swamp and with floating-leaved and submerged aquatics.

In lower Zone C-a the macrofossils continue to suggest a deep, well-vegetated lake. Higher in Zone C-a, and more strikingly in Zone C-b, annual species and shallow-water plants are common. The abundance of Zone C-b annual plants at four separate levels implies drought periods in which reed-swamp vegetation was destroyed and annuals grew on exposed lake mud. Fossils from one of the drought periods are analyzed at 2-cm intervals from a wide-diameter core. This permits an unusually close comparison of pollen and macrofossil results. Apart from the drought periods, the steady presence throughout Zone C-b of abundant annuals accompanied by shallow-water aquatics suggests a period of low water levels at Kirchner Marsh. In Zone C-c annual plants are no longer prominent, and the macroflora indicates a return to stable, deep-water conditions.

In the seed diagrams the seed abundance for each taxon is shown either as percentages of the total seeds from a variable volume of sediment or as absolute numbers for a standard volume. The percentage method is preferred for general-purpose diagrams in order to clarify the main stratigraphic trends of the macrofossils and to facilitate comparison with similarly styled diagrams. The type of diagram used, however, depends on its purpose and on the material available.

The characteristics of pollen and seeds as fossils are compared. Some concepts of pollen-analysis—regional parallelism, overrepresented species, pollen sum, and pollen rain—are found to apply usefully to seed analysis. Seeds are not so suitable as pollen for statistical study because they are less efficiently mixed in the “seed rain.” Seed diagrams, however, may show marked regional parallelism,

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which is empirical evidence of a crude mixing of seeds. Because of this process, the largest contributors to the “seed rain” are consistently represented in a seed diagram. In this sense, the principles of pollen analysis apply equally well to seed analysis, and the differences between the methods are of degree and not of kind.

Footnotes

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