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The Pennsylvanian-Permian plant fossil record of North-Central Texas and its implications for vegetational response to global climatic change

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North-Central Texas has played a pivotal role in our understanding of the Early Permian biota. Although perhaps better known for its vertebrate fossils, the rocks of NC Texas have produced arguably the best record in the world of latest Pennsylvanian to Middle Permian plants. This record captures vegetational change during the transition from the Carboniferous and Early Permian cold-Earth conditions to subsequent, long-lived warm-Earth conditions. The transition from the Pennsylvanian to the Permian involved both a resurgence of south-polar ice and a steep temperature increase in the tropics. The response of vegetation to these changes was rapid enough to appear instantaneous in the geological sense: plants typical of Carboniferous wetlands (seed ferns, tree ferns, lycopsids, and sphenopsids) were replaced across the landscape by plants typical of seasonally moisture stressed environments typical of the Permian in much of the tropics (conifers, peltasperms, cycad-like plants). Evidence suggests that the seasonally-dry biome was located in tropical extrabasinal areas and spread rapidly throughout much of the tropics in response to this climatic change; plants typical of wetter habitats persisted in small areas within the drier landscapes. The seasonally-dry biome persisted through the Early Permian, with gradual addition and loss of species, and through two cycles of large scale ice development and decay. A third and final pulse of south polar ice, at the end of the Early Permian, brought into the western parts of the tropical belt, a unique flora composed of evolutionarily derived taxa otherwise known only (and prior to their discovery in Texas) from the Late Permian and Mesozoic of Europe and Asia, indicating that such plants existed ?out there?, beyond the limits of the basinal lowlands, for some time before their appearance. The NC

Texas record indicates the following. Plant species and genera tend to cluster around certain climatic norms; they track these norms faithfully and respond rapidly to major climatic shifts. Biome/species-pool composition changes gradually over geological time and patterns of higher taxonomic dominance and diversity are remarkably stable within certain climatic limits. Evolutionary innovation at higher levels, new generic- and family-level body plans, occurs in progressively more remote areas of environmental stress where resources are undersaturated and thus more easily invaded by radical new forms.