PALEOCENE-EOCENE FLORAL AND CLIMATIC CHANGE IN THE BIGHORN BASIN

WING*, Scott L., Dept. of Paleobiology, 121 National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, U.S.A.; HICKEY, Leo J., Dept. of Geology and Geophysics, Yale University, New Haven, CT 06520, U.S.A.

Nearly autochthonous plant fossil assemblages are abundant in a variety of fluvial sub-environments in the Fort Union and Willwood Fms. of the Bighorn Basin (BHB), including abandoned channel fills, channel margins, levees, splays, and floodplain backswamps. Heterogeneity in the stratigraphic and geographic distribution of plant-bearing deposits limits our ability to resolve temporal change in floras and climate because depositional environment strongly affects floral composition, and must be considered in any analysis of floral change.

Plant-bearing levee, splay, and backswamp strata are common through much of the Fort Union Fm. in both the central and northern BHB. In the central basin, such deposits are abundant in the lower 200 m and upper 150 m of the Willwood Fm. with a gap from 350 to 620 m. In the northern BHB, the Willwood Fm. is almost entirely devoid of such plant-bearing deposits. Abandoned channel fills are scattered throughout the Fort Union and Willwood Fms. with the exception of the upper Willwood in the northern BHB and the 460-620 m interval of the Willwood in the central BHB. Deposition of plant-bearing floodplain backswamps was probably controlled by rates of aggradation, and the proximity and stability of major channels, as well as by regional climatic change. The formation of plant-preserving ponds was probably controlled less by climate than by the rate of channel cut-off and the degree to which channels reworked previous floodplain deposits. At a larger scale than these local depositional settings are sub-regional scale environments, including coal swamps, lakes, and conglomerate fans, that have a stratigraphic distribution controlled largely by tectonic activity.

Samples of fossil floras matched for depositional environment and sampling effort reveal several long-term patterns. One, the greatest number of species and fastest rate of turnover are seen in the alluvial ridge environments; backswamp samples have fewer species and slower rates of turnover. Two, floristic change during the Paleocene was relatively slow, and the Paleocene/Eocene (Clarkforkian/Wasatchian) boundary is marked by just a few extinctions and originations. The most pronounced turnover in the BHB sequence occurred between the early and late Wasatchian, probably as a result of climatic drying. Three, species number decreased from the early to mid-Paleocene, then increased steadily from 8 spp./sample in the late Clarkforkian to >12 spp./sample in the late Wasatchian.

Physiognomic analysis of floras indicates a rise in mean annual temperature from about 10° C in the Tiffanian to about 13° in the Clarkforkian and more than 18° in the early late Wasatchian; this may have been a major factor in the increasing diversity of the flora. Recent correlations of Bighorn Basin sections to standard marine zonations show that this warming trend was synchronous with global warming indicated by the oxygen isotope record.