

A COMPARISON OF LEAF FOSSILS FROM UPPER LEBO AND LOWER TONGUE RIVER MEMBERS OF THE FORT UNION FORMATION (PALEOCENE) NEAR LOCATE, SOUTHEASTERN MONTANA

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In a six-square-mile area along the east bank of the present day Powder River, about 35 miles southeast of Miles City Montana, stratigraphic sections were measured and correlated (Fig.1). Nearly 1000 leaf fossils have been collected at 7 localities within these strata (first by Beth Williams in 1987, and last summer by myself). These specimens represent between 19 to 21 families and 33 species of plants. The purpose of this project is to study the patterns of first and last appearance of these leaf-producing plants from the stratigraphically lowest to the stratigraphically highest horizons in the study interval.

The strata studied included the upper 75 m of the Lebo Member (LB) and the lower 100 m of the Tongue River Member (TR). These strata are of lower to middle Paleocene age and were deposited in a large alluvial plain in the southwest corner of the Williston Basin. The source of sand and mud lay in the vicinity of the Bighorn Mountains (Wyoming) or the Black Hills (South Dakota) (Belt et al. ms. *in press*). Sedimentologically they consist of channelbelt, levee and crevasse splay deposits, and clays and coals associated with flood basins and channel abandonment facies.

The two members of the Fort Union Formation that were studied, differ primarily in clay composition and in their amount of sand. The Lebo Member is smectite dominated, whereas the Tongue River is kaolinite and illite dominated. In addition, TR sands are more abundant than LB sands, and cover more widespread areas. They are often in coarsening up sequences. These suggest the existence of large crevasse splays and, by inference, perhaps higher energy fluvial conditions during TR time than during LB time (Belt et al. *in press*). Widespread coals found throughout the TR also tell us that there was more ponded water at the time this member was being formed than during LB time.

Valid observations about the patterns of first and last appearance of leaf fossils can be made regardless of these differences in depositional styles. It is the scope of this project to trace the appearance and disappearance patterns of leaf-producing plants within a 160 m stratigraphic interval. This section is sufficient to include multiple localities that represent the same depositional facies.

From 15 to 17 families were found in the Lebo Member, and 10 families were found in the TR Member. Ten families were represented in the Lebo but not in the TR Member. The number of families that were found in the Tongue River but not in the Lebo was only 4. Thus diversity, at least at the familial level, seems to have been lower in the Tongue River than in the Lebo by about 37.5% (Fig.2). At the species level, 23 species (Fig.3) were found in the Lebo and 14 were found in the TR. Thus the TR contains 61% of the number of species contained in the LB.

The most marked drop in species diversity is seen not at the TR/LB boundary, but within the lower 15 to 20 meters of the Tongue River, between localities 1 and 4 (Fig.3). Here one sees a decrease in number of species from 12 to 4. 32 m above this, (Fig.3, Loc.2) one new species is picked up. At the stratigraphically highest locality (Fig.2, Loc.6) 3 of the species of Loc.2 are dropped and 3 new species come in, leaving a total of 5 species. At the stratigraphically lowest locality (Fig.3, Mex. Hat) 20 species had been represented.

Only 4 of the species found above locality 1, *Cissus marginatus*, *Viburnum Asperum*, VALI species 18 (VALI-18) and VALI species 19 (VALI-19) (Fig.3) were not found within Lebo strata. Thus the total number of species above locality 1 is 18% of the total number of species found both within the Lebo and the TR members.

Leaf fossils of the families Platanaceae and Cercidiphyllaceae seem to be most representative of both the TR and LB members, up through locality 1. The Cercidiphyllaceae disappear from the record above locality 1 (Fig.1). The Platanaceae are present all the way through to the stratigraphically highest locality. Of particular note are the presence of the family Palmae in the upper Lebo and in the lower TR, and of the species *Populus Nebraskaensis* in the lower TR.

The age of the strata immediately below the Mexican Hat locality is believed to be Torrejonian. This age is based upon aquatic tetrapod and fish bones identified by J.H.Hutchison (Berkeley). The Torrejonian/Tiffanian boundary has not yet been determined within these strata. L.J.Hickey and K.R.Johnson suggest that the Tiffanian is characterized, megaflorally, by low diversity. However, it is not possible to locate this boundary solely on the basis of the magnitude of megafloral diversity in this study. Vertebrate fossils found within the lower 100 m of the TR are now being studied in an attempt to find out whether they shed light on this problem. Should they indicate Tiffanian characteristics it is possible that the drop in number of leaf fossil species seen somewhere between localities 1 and 4 will be of help in determining the exact locality of the boundary.

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KEY:

COAL

SSTN

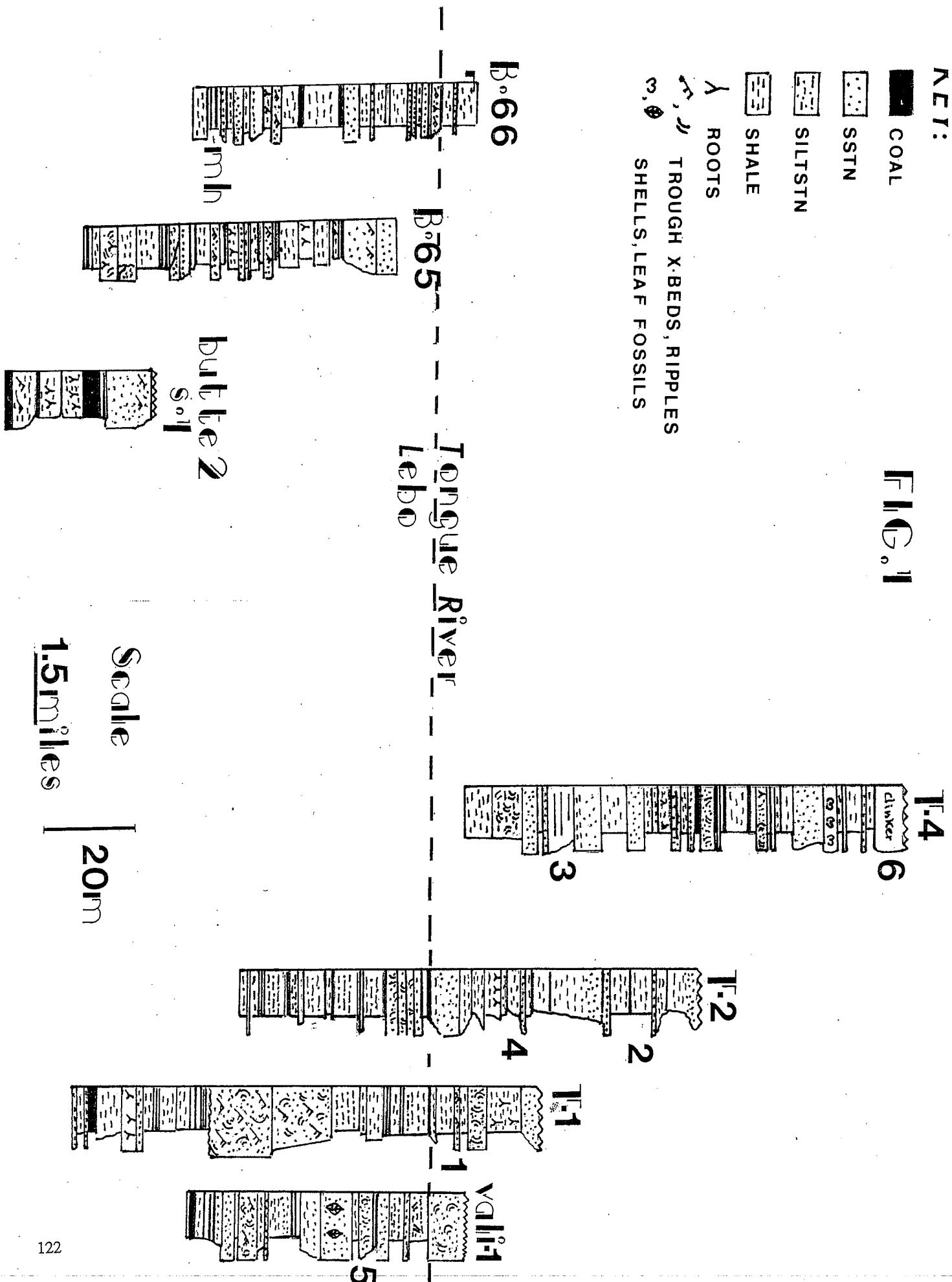
SILTSTN

SHALE

ROOTS

TROUGH X-BEDS, RIPPLES
SHELLS, LEAF FOSSILS

FIG. 1



Scale
1.5 miles | 20m

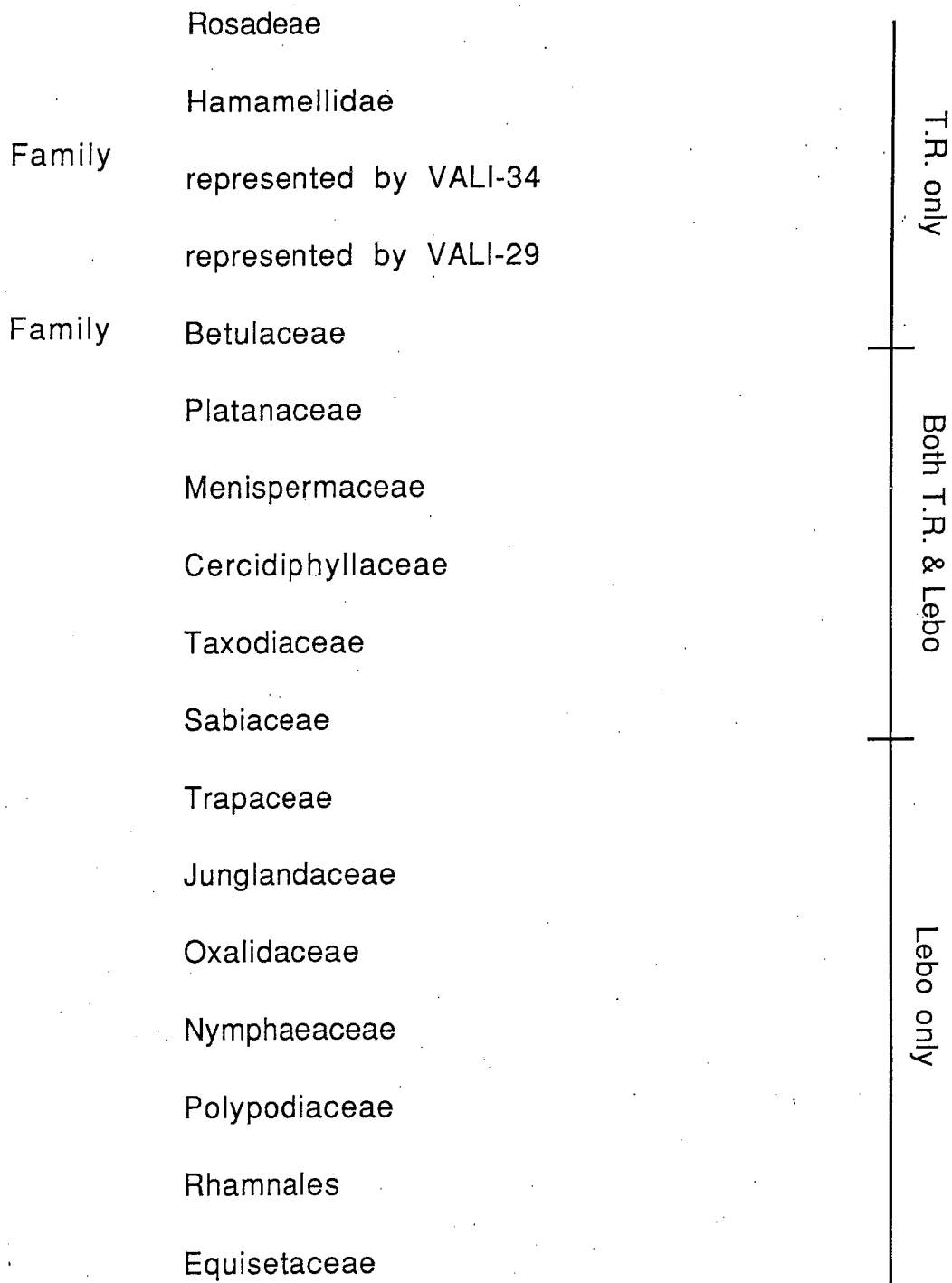


Fig. 2. Families represented by Lebo and Tongue River members of the Fort Union Formation. Not in order of stratigraphic appearance.

