

DEPOSITIONAL ENVIRONMENTS AND POSSIBLE SOURCE AREAS
FOR THE
FORT UNION FORMATION, SOUTHEASTERN MONTANA

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The Fort Union Formation is a widespread sedimentary deposit that dates from the Early Paleocene. It is an important component of the Bighorn, Powder River and Williston Basins, cropping out in North Dakota, Wyoming, and Montana (See figure 1). In southeastern Montana, the Fort Union formation includes three members known as the Tullock, Lebo, and Tongue River Members. It occurs as horizontally bedded sands and muds of varying colors and grain sizes interbedded with coal seams and carbonaceous shales.

The upper part of the Lebo and lower third of the Tongue River Members of this Formation are similar in many ways. They both have interbedded sands, muds, and lignitic coals and are horizontally bedded, yet they have differences so distinct that it is obvious that they were deposited in different sedimentary environments. The Lebo Member has lenticular sands which are white in color and smectitic muds which are dark gray. It contains coal beds that average approximately one and a half meters in thickness. The part of the Tongue River Member that was studied has sheet sands and non-smectitic muds that are generally more yellow and a lighter gray than those found in the Lebo. The coals in the Tongue River Member are thinner and are very continuous laterally. In this study, I examined general models of several sedimentary environments and was thus able to explain some of the differences between the two Paleocene environments of these two Members.

The sands and coals found in the Lebo Member indicate that the area was reworked by channels to a great extent during the time of its deposition. The thickness of the many of the coals suggest that their parent coal swamps were under water for long periods of time, possibly the function of a high water table. On the other hand, the Tongue River Member has thinner beds of mud, sand, and coal that repeat with great regularity. The presence of sheet sands with molluscs might indicate that the channels that existed at the time drained poorly due to a lower water table. The differences in the sands might also be explained by a change in the rate of subsidence of the crust as the basin was formed.

The source of the sediment that makes up the Fort Union Formation is still an unanswered question. In an attempt to gain some insight to this problem, I separated the heavy minerals out of several sand samples taken from each of the three members of the Fort Union using a non-toxic heavy liquid known as sodium polytungstate (See figure 2). Using both transmitted light and oblique reflected light, I was able to identify the following minerals: magnetite, epidote, apatite, hematite. The presence of these minerals is consistent with the hypothesis that the sediment of the Fort Union Formation in southeastern Montana issued from mountain block uplifts to the west, but does not restrict the provenance to any one uplift. These uplifts primarily include the Black Hills in South Dakota, the Bighorn Mountains in Wyoming. Any or all of these uplifts could be possible source areas for the channels that deposited the Fort Union Formation.

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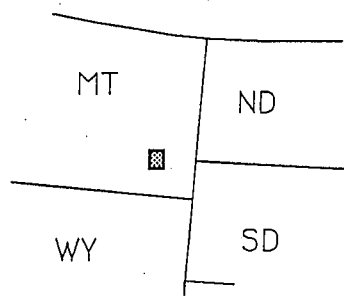


Figure 1. Map of field area in southeastern Montana. (Computer work by Dave Bice, 1989).

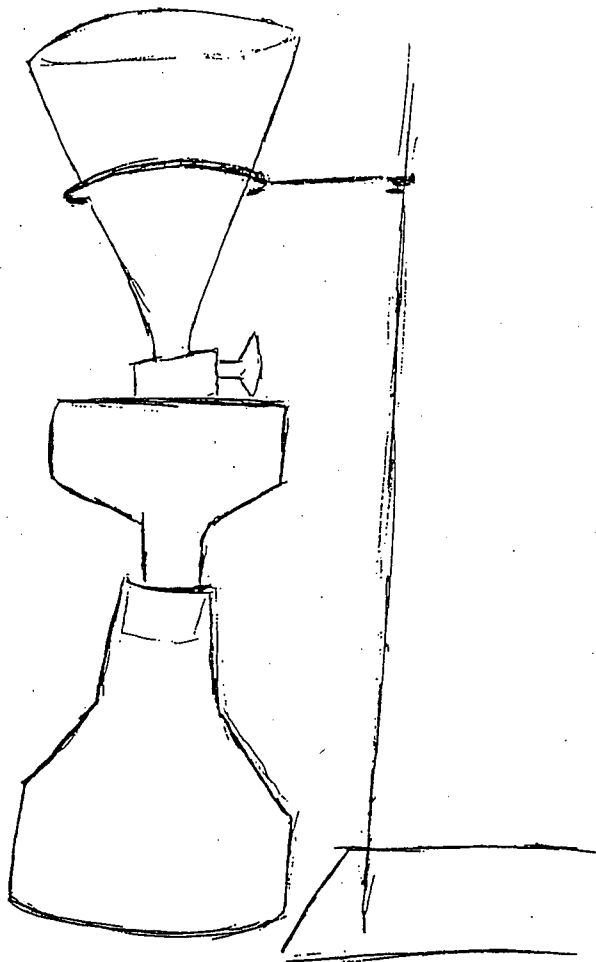


Figure 2. Laboratory setup for heavy mineral separation. (Artwork by Kim Hannula, 1989.)