Loess Deposits of Southeastern Idaho: Age and Correlation of the Upper Two Loess Units

by

Kenneth L. Pierce¹, Maynard A. Fosberg², William E. Scott¹, Glenn C. Lewis², and Steven M. Colman¹

ABSTRACT

Loess deposits in southeastern Idaho are subdivided into stratigraphic units on the basis of stratigraphic position, buried soils, and relations to other stratigraphic units. The upper unit, loess unit A, covers most of the landscape where slopes are gentle and underlying units are older than about 15,000 years. The next older unit, loess unit B, is present at stable sites where loess unit A is thick and where the underlying substratum is older than about 150,000 years. Loess units A and B seem to be consistent stratigraphic units that can be correlated over a transect 400 kilometers long. Accumulation of loess unit A ceased about 10,000 years ago, as indicated by the degree of soil development, the relation to deposits of both the Pinedale Glaciation and the Bonneville Flood, and the absence of significant loess on Holocene basalts. Loess unit A rests locally on a buried soil that is significantly better developed than the surface soil in loess unit A. A buried soil more strongly developed than the surface soil is present on glacial deposits 140,000-150,000 years old but is not present above a pumice bed correlated with a rhyolite dome 61,000 ± 6,000 years old and a basalt 72,000 ± 14,000 years old. Thus, the upper loess unit appears to have accumulated between about 70,000 and 10,000 years ago and probably correlates with the Wisconsin Glaciation. Because the buried soil on loess unit B is significantly better developed than the surface soil, it probably formed during an interval several times the 10,000 years represented by the surface soil, presumably between about 130,000 and 70,000 years ago. Loess unit B probably accumulated during an interval that ended shortly after 140,000 to 150,000 years ago and that was roughly similar in duration to that of loess unit A.

INTRODUCTION

Geologic studies, particularly since 1975, have yielded enough stratigraphic and age information to justify a preliminary synthesis of the age and correlation of loess deposits on and adjacent to the eastern Snake River Plain (Figure 1). We summarize here information on the stratigraphy and dating of the upper two loess units and present a correlation diagram for eleven loess sections along a 400-kilometer transect from West Yellowstone, Montana, to Gooding, Idaho. Further studies of these loess deposits and associated basalt flows and volcanic ash beds will yield additional age information, especially for loess deposits older than the upper two loess units. We limit this discussion to the two youngest loess units, because most of the available stratigraphic and dating information pertains to them. We also limit this discussion to age and correlation of the loesses, for a companion paper by Lewis and Fosberg (1982 this volume) describes the distribution, thickness, and character of the loesses in southeastern Idaho.

The stratigraphic subdivision of loess deposits is accomplished by using soils developed in the upper part of each loess unit. Depending upon the local climate, a weakly to moderately developed soil is formed in the uppermost loess (loess unit A). This soil is similar in degree of development to the soil formed in late Pleistocene or Pinedale-age deposits in comparable environments and to that formed in Holocene time. Thus, both the degree of soil development and the general lack of loess deposition in the Holocene suggest a late Pleistocene age for the upper part of loess unit A. Roadcuts, mine exposures, and backhoe pits show that loess unit A generally mantles all older loess units, except along bluffs and other actively eroding areas. In multiple-unit loess sections, the...
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Figure 1. Location map of eastern Snake River Plain, southeastern Idaho. Numbered sites are locations of loess sections shown in Figure 2. Shading indicates mountainous areas.

base of loess unit A is marked by the top of a buried soil that is better developed than the surface soil.

The top of the next older loess unit, loess unit B, is marked by a buried soil that is better developed than the surface soil. The base of loess unit B is the top of the next deeper buried soil that is comparable to or better developed than the surface soil. Loess unit B can be recognized with confidence only in flat upland areas or in other areas where exposures suggest that no loess units have been removed by erosion.

The loess units generally do not contain datable material, although volcanic ash layers or lenses do occur locally. However, in some areas the loess units overlie numerically dated Quaternary basalts, glacial deposits, and flood-scoured surfaces, and in others the loess units overlie deposits whose relative or approximate numerical age is known. Given an increasing progression of ages for underlying units, the ages of increasingly older loess units and soils can be approximated.

Previous researchers have estimated differing ages for the loess deposits of southeastern Idaho. Bright (1967) named the loess in the Thatcher basin the Niter Loess and described stratigraphic relations suggesting it was late Pleistocene to perhaps Holocene age. McDole (1969, p. 7) deduced that the thick loess sequence and included paleosols near Pocatello dates from between 75,000 and 30,000 years old because (1) no loess had accumulated on deposits of the Bonneville Flood, which were then thought to be about 30,000 years old and (2) none of the buried soils within the loess sequence were as strongly developed as he expected pre-Wisconsin soils to be. In contrast, Richmond (1973) concluded that the thick upper loess unit mantling glacial deposits southwest of Yellowstone National Park was of Pinedale age, which is in accord with our conclusions.

DESCRIPTION OF STRATIGRAPHIC SECTIONS

The eleven loess sections described here were selected because they provide useful information on the stratigraphy, correlation, and age of the upper two loess units along the length of the eastern Snake River Plain (Figures 1 and 2).

The best stratigraphic and age control for loess deposits comes from the West Yellowstone basin (Figure 2, site 1). Combined obsidian-hydration and potassium-argon methods date the age of glacial abrasion of obsidian in Bull Lake moraines at about 140,000 to 150,000 years old and that in Pinedale terminal moraines at about 30,000 years old (Pierce and others, 1976; Pierce, 1979). Carbon-14 and obsidian-hydration dating reveal that deglaciation of the Yellowstone Plateau occurred by about 14,000 years ago. Results of weathering-rind studies are consistent with these age assignments (Colman and Pierce, 1981).

Loess commonly overlies Bull Lake deposits in the West Yellowstone basin. At localities where the upper loess is more than 0.5 meter thick, a buried soil commonly can be distinguished below the surface soil (Figure 2, site 1; Pierce, 1979, Figure 11,
Figure 2. Stratigraphic sections along a 408-kilometer transect from West Yellowstone, Montana, to Bliss, Idaho, showing loess units, surface and buried soil horizons, and available dating of substrates for the sites shown on Figure 1. Estimates of mean annual precipitation (MAP) after Thomas and others (1965, Plate 2) and from other information.
locations 5 and 6). The loess at the ten other sites described here has about 15 percent original CaCO₃ equivalent, whereas the loess in the West Yellowstone basin is noncalcareous, at least in part because bedrock in the outwash source area of the West Yellowstone basin is largely noncalcareous.

Site 1 (Figure 2) is a reexcavation of a soil pit originally dug in the late 1960's by Fred Nials. The surface soil in loess unit A is weakly developed and similar to the soil on Pinedale moraines 20 kilometers to the east (Pierce, 1979, Figure 11). On the basis of sequence and soil development, loess unit A is correlated with nearby glacial deposits assigned to the Pinedale Glaciation. Loess unit A overlies a buried soil developed both in silty sediment and in the upper part of kame gravels mapped by Waldrop (1975) as Bull Lake in age. The silty sediment is also assigned a Bull Lake age, because it conformably overlies the kame gravel. This silty sediment is most likely loess altered by soil development and is here assigned to loess unit B. Compared with the surface soil, the B horizon of the buried soil has colors two chromas stronger, a thickness about 50 percent greater, and about twice as much clay (about 35 percent compared with 18 percent in field estimates by Fosberg). However, parent-material differences may complicate this comparison. Bull Lake moraines, and presumably loess unit B, are rich in basalt clasts which weather more readily than the rhyolitic material that makes up the bulk of the Pinedale moraines, and presumably loess unit A (Figure 2, site 1). Despite this parent-material difference, the development represented by the buried soil still appears to represent more time than that represented by the surface soil.

At the upper end of the Snake River Plain near Ashton, loess unit A commonly exceeds 5 meters in thickness. Carbonate has been leached from the soil in loess unit A to a depth of about 0.5 meter; the calcic horizon generally reaches only stage III and is not cemented (Gile and others, 1966). Site 2 (Figure 2) is in deep railroad cuts just northwest of France, Idaho. Here, as much as 7 meters of loess unit A overlies a buried soil developed in till and colluvium and loess. The till was deposited by a large glacier originating in the Yellowstone-Teton area. We have not excavated and described this buried soil in detail, but it appears locally to have a calcic horizon about several tenths of a meter thick.

To the east of site 2, the loess cover thins on till that we believe is equivalent to the till at site 2. Where the loess cover is thin or absent, weathering rinds on basaltic stones in the till are about 0.9 millimeter thick, as compared with about 0.3 millimeter for rinds in the next younger till (Colman and Pierce, 1981, p. 50). Rind thicknesses on basalt stones in the West Yellowstone basin are about 0.8 millimeter in Bull Lake deposits and about 0.4 millimeter in Pinedale terminal moraines (Colman and Pierce, 1981, p. 44). Thus, both the loess-till stratigraphy and weathering rinds suggest a strong similarity between sites 1 and 2.

In the Teton Basin 8 kilometers northeast of Driggs, Idaho, loess thickly mantles moraines at the mouth of Teton Canyon (Figure 2, site 3). These moraines predate the last glaciation (Pinedale) but still retain constructional form, particularly along the bouldery lateral moraines high on the canyon walls just east of the mountain front. We agree with Edmund's (1951, Figure 7) assignment of these moraines to the Bull Lake Glaciation, although we would draw the Pinedale limit much farther down valley than he does. A combination backhoe and auger excavation, extending to a depth of 5.5 meters, exposed a well-developed buried soil beneath loess unit A. This site is relatively wet compared with the other sites, and loess unit A is leached of carbonate to a depth of 90 centimeters. At a depth of 1 to 2.6 meters in loess unit A, slightly reddened loess with a moderate, subangular, blocky structure indicates alteration, perhaps by weathering, as loess slowly accumulated on the land surface. The A horizon of the well-developed buried soil occurs at a depth of 2.6 meters. This soil and oxidized colluvium is more than 3 meters thick and is developed in loess unit B and in colluvium from the underlying Bull Lake moraines; this soil is clearly more developed than the surface soil.

Site 4 is on the outwash fan graded to the Bull Lake moraines of site 3. The loess and buried-soil sequence is similar at the two sites, although loess unit A at site 4 is thinner and the depth of leaching is less because site 4 is lower and drier. The Cca horizon of the surface soil extends down into the B horizon of the more developed buried soil, which is formed in both loess unit B and outwash of Bull Lake age (Figures 2 and 3). The calcic horizons of the buried soil include a calcic horizon with stage III development.

Site 5 is an exposure in the banks of the Blackfoot River about 20 kilometers north of Soda Springs, Idaho. At this site and additional sites to the north and east, a tephra zone with rhyolitic and basaltic pumice blocks overlain by light gray sandy pumice occurs in the lower part of loess unit A. At site 5, the tephra zone is 3.8 meters below the top of loess unit A and is 1 meter thick, containing pumice blocks as coarse as 5 centimeters. The dposit occurs 4 kilometers east of China Hat, a 275 meter high rhyolite dome of late Quaternary age. G. B. Dalrymple (written communication, 1982) obtained
Figure 3. Loess mantling outwash gravels of Bull Lake age at loess section site 4, east of Driggs, Idaho. Cca horizon of surface soil (light-colored zone) in loess unit A overlies B horizon of buried soil developed in loess unit B. K horizon of buried soil cements outwash gravels.

a potassium-argon age of 61,000 ± 6,000 years on sandine concentrate from a sample collected at China Hat by W. D. Leeman. At the base of the China Hat dome, rhyolitic tephra more than 8 meters thick is mantled by a mixture of pumaceous deposits and loess washed from China Hat, which in turn is overlain by the upper part of loess unit A in which the surface soil is developed. Two other rhyolite domes, Middle Cone and North Cone occur to the north of China Hat. The thickness of hydration rims on pumice from site 5 is 13.6 ± 1.3 micrometers (n =12), almost identical to the value of 13.5 ± 0.8 micrometers (n=15) determined for that on pumice from a pit at the base of China Hat, indicating that the potassium-argon date from China Hat also applies to the pumice unit at site 5.

At site 5, the surface soil has a B horizon 1 meter thick with well-developed prismatic structure, and the loess is leached of carbonate to a depth of 1.5 meters (Figure 2). This thick B horizon and deep leaching reflects the relatively high precipitation estimated to be about 50 centimeters at this site, and especially the extensive soil wetting accompanying the melting of a thick winter snowpack. The water content of the April 1 snowpack at a nearby site 100 meters higher averages 23 centimeters (Wilson and Carstens, 1975, p. 11), and local snows are deep as evidenced by a snowmobile racetrack located immediately across the Blackfoot River from site 5. At a depth of 3.25 meters, a buried soil with a B horizon about 30 centimeters thick occurs just above the China Hat tephra. Because this soil is definitely less developed than the surface soil, it does not represent the top of loess unit B, but rather a relatively minor soil in locas unit A that was formed probably not too long after the tephra was deposited.

Site 6 is on the northern flank of the Kettle Butte volcano about 30 kilometers northwest of Idaho Falls. This shield volcano is thickly mantled with loess on its northeastern, downwind side; but on the southwestern side, local outcrops of pressure ridges suggest to us an age not in excess of half a million years. At site 6, a weak soil is developed within loess unit A (Figure 2). This loess is about 2 meters thick and overlies a buried soil developed in loess unit B. The unweathered loess contains about 10-15 percent clay and 10-15 percent CaCO₃ equivalent. Compared with the surface soil, this buried soil is thicker, its B horizon contains 21 percent clay compared with 16 percent, and its calcic horizon is thicker and contains 58 percent CaCO₃ equivalent compared with 21 percent (Moody and others, 1979, site 77Ida1008). Loess unit B rests on the basalt of Kettle Butte. Based on regional studies, M. A. Kuntz (written communication, 1981) considers this basalt to be considerably younger than the basalt of Shattuck Butte, which is 15-20 kilometers to the east of Kettle Butte and is dated as 643,000 ± 57,000 years old (G. B. Dalrymple, written communication, 1980).

East of Blackfoot, R. E. McDole, M. A. Fosberg, and G. C. Lewis studied the loess and buried soils in backhoe pits and in hand-augered holes in the bottom of these pits. They named the upper loess (unit A) the Bannock Loess, and the first prominent buried soil the Fort Hall Geosol (McDole, 1969, McDole and others, 1973). Site 7 is about 300 meters above the Snake River and is plotted from the descriptions of McDole (1969, locality 0694). Unweathered loess at this site has about 7-11 percent clay and 15-18 percent CaCO₃ equivalent. The first buried soil (developed in loess unit B) is thicker and more developed than the surface soil, having 18 percent clay compared with 13 percent and 34 percent CaCO₃ equivalent compared with 23 percent (McDole, 1969, locality 0694, Tables 4 and 13). At this site, loess unit B rests on a well-expressed buried soil developed in an older loess (loess unit C)?

In the Pocatello area, the age of the upper part of loess unit A can be determined from deposits and scoured surfaces of the Bonneville Flood, which occurred between about 15,000 and 14,000 years ago (Scott and others, 1982 this volume). Site 8 (Figures 2 and 4) is on the surface of flood-scoured basalt of Portneuf Valley. Thin, discontinuous flood-gravel and broad depressions show that the basalt bench between Pocatello and Portneuf was scoured by the Bonneville Flood. As much as 1.5 meters of loess locally mantles this basalt (Figure 4), but more typically, loess thicknesses are 0 to 0.5 meter. At site 8, a typical Holocene soil is developed in the loess, indicating that it is loess unit A. In areas underlain
Figure 4. Loess at site 8 that accumulated on mid-Quaternary basalt after basalt was scoured by Bonneville Flood about 14,000-15,000 years ago. Loess above dashed line is about 1.5 meters thick, but loess thickness on this flood-scoured basalt and on Bonneville Flood deposits probably averages less than 30 centimeters. Exposure in roadcut along Interstate Highway 15, 0.4 kilometer northwest of Portneuf, Idaho. Entrenching tool in center of photograph is about 50 centimeters long.

by Bonneville Flood deposits or in areas scoured by the Bonneville Flood, loess unit A is roughly 10-20 percent of its full thickness in nearby localities above the level of the flood, indicating that the Bonneville Flood occurred near the end of deposition of loess unit A. The postflood loess may be disproportionately thick here relative to the interval of time during which it was deposited, because it probably accumulated quickly as sediment was deflated from flood deposits and flood devegetated areas.

The best radiometric-age control for the base of loess unit A is the potassium-argon age of the Cedar Butte Basalt, about 20 kilometers southwest of American Falls. This basalt is 72,000 ± 14,000 years old (G. B. Dalrymple, written communication, 1981; see Scott and others, 1982 this volume, for analytical results). At site 9 (Figure 2), the Cedar Butte Basalt is mantled by sandy loess 2 meters thick. This loess bears a Holocene surface soil typical for the local climate. The loess does not contain buried soils, but a zone of secondary carbonate was found on top of the basalt. No soil horizionation was observed in this caliche, and we consider it to be of vadose-water origin. Soils in this area are wetted primarily by winter and spring moisture, and drifting snow is probably important at this east-facing site. Soil water cannot move readily into the cracks in the underlying basalt until the loess is saturated to field capacity. In this semiarid area where the entire loess column would seldom exceed field capacity, most of the water is held in the loess. During the growing season, the last remaining soil water would tend to concentrate at the base of the loess. Plant roots, which are common in this zone, would withdraw water, leading to precipitation of carbonate at the base of the loess.

Site 10 (Figures 2 and 5) is one of several similar localities at the margin of the Snake River Plain in the northern Raft River valley. At these sites, one buried soil occurs in the loess succession mantling
Figure 5. Loess units A and B exposed in roadcut of Interstate Highway 86 at loess section site 10, Raft River valley, Idaho. The most clay-rich part of the B horizon of the buried soil in loess unit B occurs just above the small pit. Man in pit is sitting on top of basalt of Yale Road.

The basalt of Yale Road and the “basalt of the old railroad grade” (Williams and others, 1982 this volume). The southern part of the basalt of Yale Road is thickly mantled with loess, but the northern part is mostly blown free of loess and shows original flow-top topography. Based on our field experience, this basalt is not more than a few hundred thousand years old. Site 10 is in the dry, central part of the valley, just north of Interstate Highway 86 crossing the Raft River. The surface soil at site 10 is calcareous to the surface, displaying a weak cambic B horizon above a weakly developed Cca horizon about half a meter thick. The buried soil has stronger colors than the surface soil and contains the following features not present in the surface soil: a zone 0.5 meter thick leached of primary carbonate, an argillic B horizon with as much as 44 percent clay, and a siliceous duripan 0.5 meter thick. Roadcut exposures show that loess unit B is generally present only in topographic lows on top of the basalt of Yale Road, suggesting that the basalt was emplaced late in the time of deposition of loess unit B. The buried soil at site 10 formed in a topographic low where sediment rich in clay was washed from the adjacent slopes and soil moisture was enhanced. Thus, this buried soil shows more development than it would in a typical upland site. The basalt has not been radiometrically dated but is estimated on the basis of the two mantling loess units to be less than half the age of nearby basalt flows, dated between about 500,000 and 700,000 years old, which are mantled by at least four loess units (Williams and others, 1982 this volume).

Site 11 (Figure 2) is on the McKinney Basalt about halfway between Gooding and Bliss, Idaho. About 10 kilometers to the southwest adjacent to the Snake River canyon, the loess mantle is thick enough on the McKinney Basalt that nearly all of it can be farmed. North of this site toward the source of this basalt at McKinney Butte (Malde and Powers, 1972), original flow topography is well preserved, suggesting an age less than half a million years. The McKinney Basalt dammed the Snake River, forming a lake (Malde, 1982 this volume). Sediments are estimated to have accumulated in this lake for roughly 25,000 years (Malde, 1981, p. 35). The basalt dam impounding this lake was then breached and the Snake River canyon below Bliss was eroded (Malde, 1982 this volume), probably over a period of at least another 10,000 years prior to the time of the Bonneville Flood about 15,000 years ago (Scott and others, 1982 this volume). Thus the McKinney Basalt is probably about 50,000 years old.

At site 11, the loess is 2.5 meters thick. The surface soil is typical of a Holocene soil in this environment, having a leached B horizon 40 centimeters thick with 9-13 percent clay compared with 6-7 percent in the unweathered loess, and a Cca horizon 0.5 meter thick with 13-16 percent CaCO₃-equivalent compared with about 10 percent in the unweathered loess. No buried soil is present in or above the basalt at this site nor was any noted elsewhere on the McKinney Basalt, suggesting that the basalt was emplaced during the time of deposition of loess unit A.

**DISCUSSION**

A history of loess deposition separated by periods of nondeposition and soil development can be reconstructed from the present to more than 150,000 years ago.

During Holocene time (the last 10,000 years), loess deposition has been minimal, and the surface soil has developed in loess unit A. Little or no loess has accumulated on lava flows of Holocene age on the eastern Snake River Plain (Kuntz and others, 1982 this volume). The soil developed in loess unit A is comparable with that developed in latest Pleistocene deposits in similar climatic settings. For originally calcareous loess, this development ranges from weak profiles that are calcareous to the surface in areas with about 20 centimeters annual precipitation to profiles having argillic B horizons more than half a meter thick in areas with 50 centimeters annual precipitation (Figure 2). Calcic horizons of the surface soil are not cemented.

Based on soil development and stratigraphic relations to late Pleistocene pumice layers, glacial deposits, alluvium, and basalt flows, loess unit A
accumulated in late Pleistocene time. At site 8, local accumulations of loess unit A postdate the Bonneville Flood, which occurred about 14,000-15,000 years ago. At site 1, loess unit A is correlated in part with Pinedale moraines and outwash dated about 30,000 years old. At site 5, a coarse pumaceous tephra occurs in the lower part of loess unit A and is correlated with the emplacement of the nearby China Hat rhyolite dome, dated as 61,000 ± 6,000 years old. At site 9, the lower part of loess unit A rests on basalt 72,000 ± 14,000 years old. Thus, loess unit A appears, from the information available, to have accumulated between about 70,000 and 10,000 years ago. This interval corresponds approximately with the Wisconsin Glaciation of the midcontinental United States and with the Pinedale Glaciation of the Rocky Mountains, which is estimated to have spanned the interval between more than 40,000 and 11,000 years ago (Pierce and others, 1976).

Soils and darkened bands which may represent weak soils have been observed within loess unit A at sites 3, 5, and 6 and at other sections not described here. They represent interruptions in loess deposition or changes of rate in loess accumulation. At site 5, a buried soil that is much less developed than the surface soil occurs just above a tephra inferred to be about 60,000 years old (Figure 2). Thus, for an interval probably shorter than the Holocene (10,000 years), soil development interrupted deposition of loess unit A at some time probably much nearer 60,000 than 10,000 years ago. Additional stratigraphic studies are needed to identify and define such subdivisions of loess unit A.

Loess unit A locally overlies a buried soil developed in loess unit B. This buried soil is more developed than the post-Pleistocene surface soil, which formed in about 10,000 years. The buried soil in loess unit B is therefore estimated to have developed over several tens of thousands of years, perhaps as much as 50,000 years. Near West Yellowstone, silty sediment assigned to loess unit B overlies with apparent conformity glacial deposits assigned to the Bull Lake Glaciation and dated at about 140,000 to 150,000 years old. Loess at this site may have accumulated at the close of the Bull Lake Glaciation, so that the top of loess unit B might be only slightly younger than the glacial deposits of Bull Lake age.

At some sites where the loess is thick, the upper part of the first buried soil suggests that a soil complex is present, containing as many as three B-horizons stacked on top of each other. A soil complex is present at sites 3 and 10, as well as at other sites not described. Thus, in the time interval roughly estimated to be between about 70,000 and 130,000 years ago, thin, discontinuous deposits of loess or other fine-grained sediment may have locally accumulated on the landscape. Other areas were more stable, and soils continued to develop without interruption.

The age for the base of loess unit B is not well defined. At sites 1, 2, 3, 4, and 10, the substratum probably dates from late in the time of accumulation of loess unit B. The only dating is at site 1, where the underlying kame gravels of Bull Lake age are dated at 140,000 to 150,000 years old. A Bull Lake age for the age of the substratum at sites 2, 3, and 4 is inferred on the basis of glacial correlations. For the sections on the transect (Figure 2), the oldest part of loess unit B occurs at site 7 and probably also at site 6, but no dating is presently available.

Three of the loess sections described here are underlain by basalt flows that have not yet been radiometrically dated. The arguments made in this paper for the age of the loess can be reversed to provide estimates of the ages of the undated basalt flows. At site 6, the basalt of Kettle Butte is inferred to be somewhat older than 150,000 years, based on the similarity of the mantling loess succession with that in the West Yellowstone area. At site 10, the mantling loess sequence is quite similar to that in the West Yellowstone basin, suggesting an age of about 150,000 years for the basalt of Yale Road. And at site 11, the loess mantle is similar to that above the Cedar Butte Basalt, suggesting an age in the 50,000- to 70,000-year range for the McKinney Basalt.

Although unresolved problems remain concerning the possible desert origin of some of the loess in Idaho, the available information suggests that the bulk of the loess along the eastern Snake River Plain accumulated during glacial times and that the major sources were the flood plains of large streams and the active alluvial fans on and adjacent to the Snake River Plain (Pierce and Scott, 1982 this volume).

ACKNOWLEDGMENTS

We thank M. C. Reheis and V. S. Williams for helpful reviews of this report. The new potassium-argon age for the China Hat rhyolite dome, the Cedar Butte Basalt, basalt of Shattuck Butte, and older basalt at the mouth of the Raft River valley were determined by G. B. Dalrymple.

REFERENCES


