

Surficial Geology of the Brule 7.5 Minute Quadrangle, Nebraska

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Surficial Geology Overview

The Brule 7.5 Minute Quadrangle is located in southwest Nebraska along the South Platte River (Fig. 1). Here the South Platte River has incised, creating an alluvial valley that is approximately 98 meters (320 feet) deep (Fig. 2). The surficial and near subsurface geology of the area is dominated by Quaternary alluvial sediments of the South Platte River that are locally overlain by late Quaternary Peoria Loess as well as alluvial fan deposits. Tertiary sediments dominated by siltstones and sandstones directly underlie the Quaternary sediments within and around the Brule 7.5-Minute Quadrangle. The majority of the mapping area is directly underlain by Miocene Ogallala Group Ash Hollow Formation sediments (Burchett and Pabian, 1992) that overlie Brule Formation sediments of the Oligocene White River Group. The Brule Formation subcrops directly below Quaternary alluvium beneath the current South Platte River (Burchett and Pabian, 1992) where the Ogallala sediments have been removed by erosion.

South Platte River Valley Geology

The alluvial fill within the South Platte River Valley is typically up to 12 meters (40 feet) of sand and sand and gravel with lesser quantities of silt (Fig 2). Locally these Quaternary alluvial deposits may exceed 50 meters (170 feet) in thickness. The valley includes three primary alluvial deposits from the South Platte River. The youngest of these (mapped as Qasp1a and Qasp1b) show primary alluvial morphology and the tops of these surfaces lie within ~ 1.5 meters (5 feet) of the present South Platte River level. The Qasp2 surface shows subdued alluvial morphology as these features have been partially infilled by alluvial sediments from flooding events. These surfaces lie between ~2.1 to 2.3 meters (6.9 to 7.6 feet) above the present river level. A conspicuous paleochannel (mapped as Qasp2_pc) lies within the Qasp2 surface. The Qasp3 surface ranges from 2.6 to 2.8 meters (8.4 to 9.3 feet) above the present floodplain and this surface does not show primary alluvial morphology. Both the northern and southern edges of the valley contain alluvial terraces that are nearly completely covered by alluvial fans. These surfaces are mapped as Qaf_Qat. The coalesced fans are sourced from both loess and older alluvial deposits found in the adjacent uplands. On both sides of the valley these surfaces slope dramatically from the adjacent uplands toward the valley center. Optically stimulated luminescence (OSL) dating results provide age control for several of the alluvial deposits within and along the valley. An age from 2.7 meters (9 feet) within the Brule 3 core indicates that the Qasp2 surface dates to approximately 6,500 ± 400 years ago.

The uplands immediately adjacent to the South Platte River Valley are underlain by varying thicknesses of Quaternary alluvium which are locally covered by Peoria Loess. The north side of the valley shows alluvial terrace trends that are locally dissected by wind deflation scours as well as relatively thick loess deposits. Both the loess and wind deflation scours are notably orientated northwest-southeast. Alluvial terrace trends are clearly visible along the northern edge of the mapping area, as well as in the area immediately to the northwest of the Brule 7.5-Minute Quadrangle. The northern edge of the South Platte River Valley is heavily dissected by ephemeral streams, exposing Quaternary alluvium that underlies a cover of Peoria Loess. Loess in this area can exceed 35 meters (117 feet) in thickness and overlies approximately 24 meters (80 feet) of Quaternary alluvial fill that sits atop Miocene Ash Hollow Formation. The uplands on the north side of the South Platte River Valley likely includes multiple different Quaternary age loess units. The southern side of the South Platte River Valley contains a similar geologic sequence. The uplands are cored by Miocene Ash Hollow Formation and varying thicknesses of Quaternary alluvium that is in turn covered by Peoria Loess (Fig. 2). CSD Test Holes from the area show thin loess (< 1 m (3 feet)) that overlies late Quaternary alluvium that is ~ 5 meters (15 feet) thick. Historic CSD Test Holes indicate the top of the Brule Formation is at ~ 950-960 meters (3,120-3,150 feet) elevation above sea level in the mapping area. The fans here slope from south to north. The southern valley wall is dissected, but the relief is subdued relative to its northern counterpart. An OSL age from 2.6 m depth in the Brule 4 core indicates that the alluvial sediments here date to approximately 21,600 ± 2,700 years ago. OSL samples from cores Brule 5 and 6 indicate that the alluvial deposits underlying the loess in this portion of the mapping area are older than 42,000 years ago. Both of these OSL samples were saturated and therefore could only provide a minimum age estimate.

Key Findings

An interpretive geologic cross-section shows the stratigraphy of the South Platte River Valley in this area, including the thicknesses of the Quaternary alluvial fills, as well as the depth to Ogallala and Brule sediments.

This mapping effort identified thick alluvial fan sequences along the uplands on both the north and south sides of the South Platte River Valley. The fans primarily cover Quaternary alluvial terraces.

An OSL age from an alluvial terrace on the south side of the valley shows the South Platte River incised approximately 36 meters (119 feet) since ~22,000 years ago. An OSL age from the Qasp2 alluvial fill indicates it was deposited approximately 6,500 years ago. Older alluvial terrace fills on the south side of the mapping area were assigned minimum ages of 42,000 years ago.

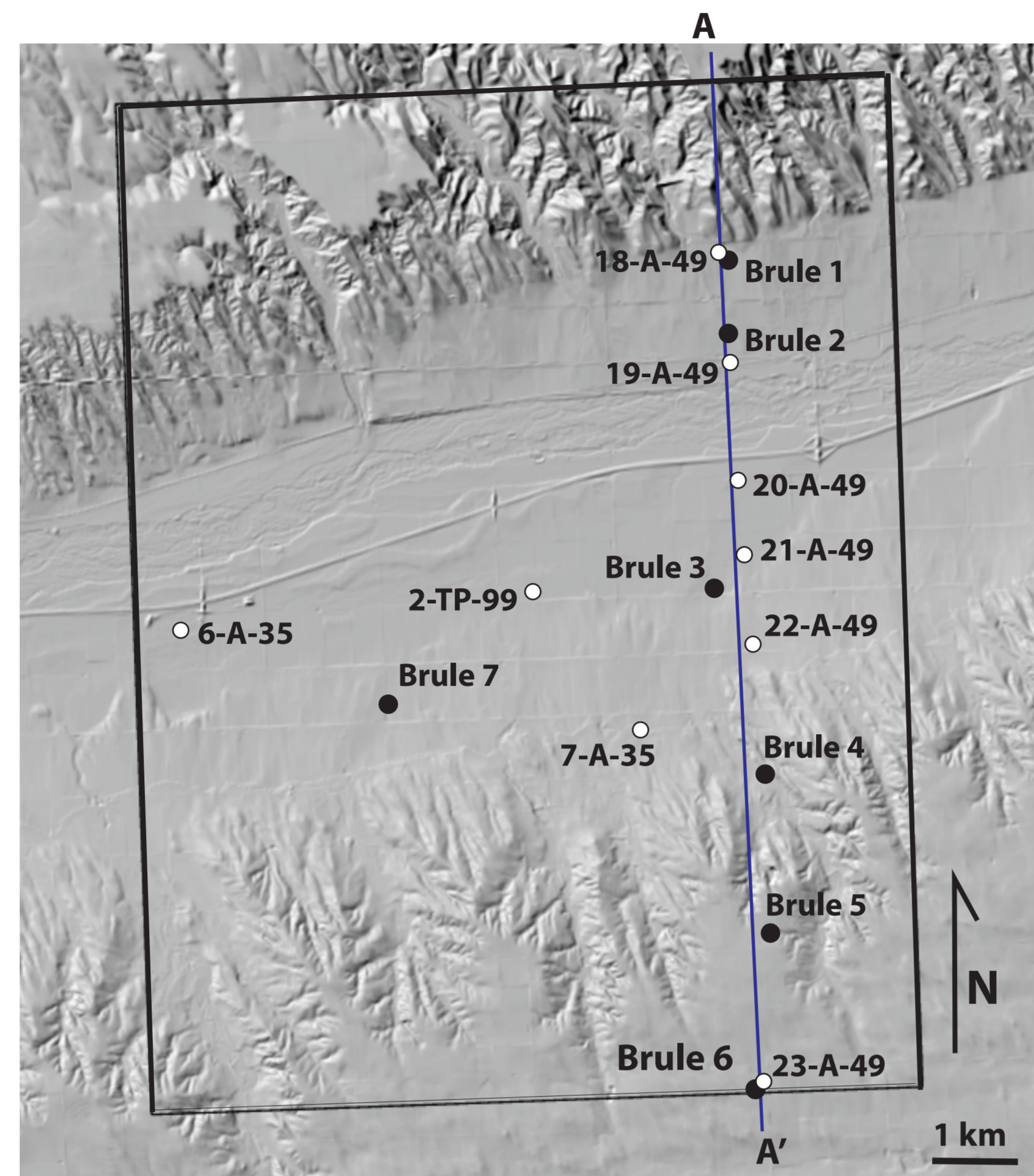


Fig 1. Hillshade generated from LiDAR data for the Brule 7.5 minute quadrangle showing historic CSD test holes (white dots) and cores collected during this project (black dots) and the interpretive geologic cross-section from A to A'. The South Platte River Valley is approximately 98 m (320 feet)

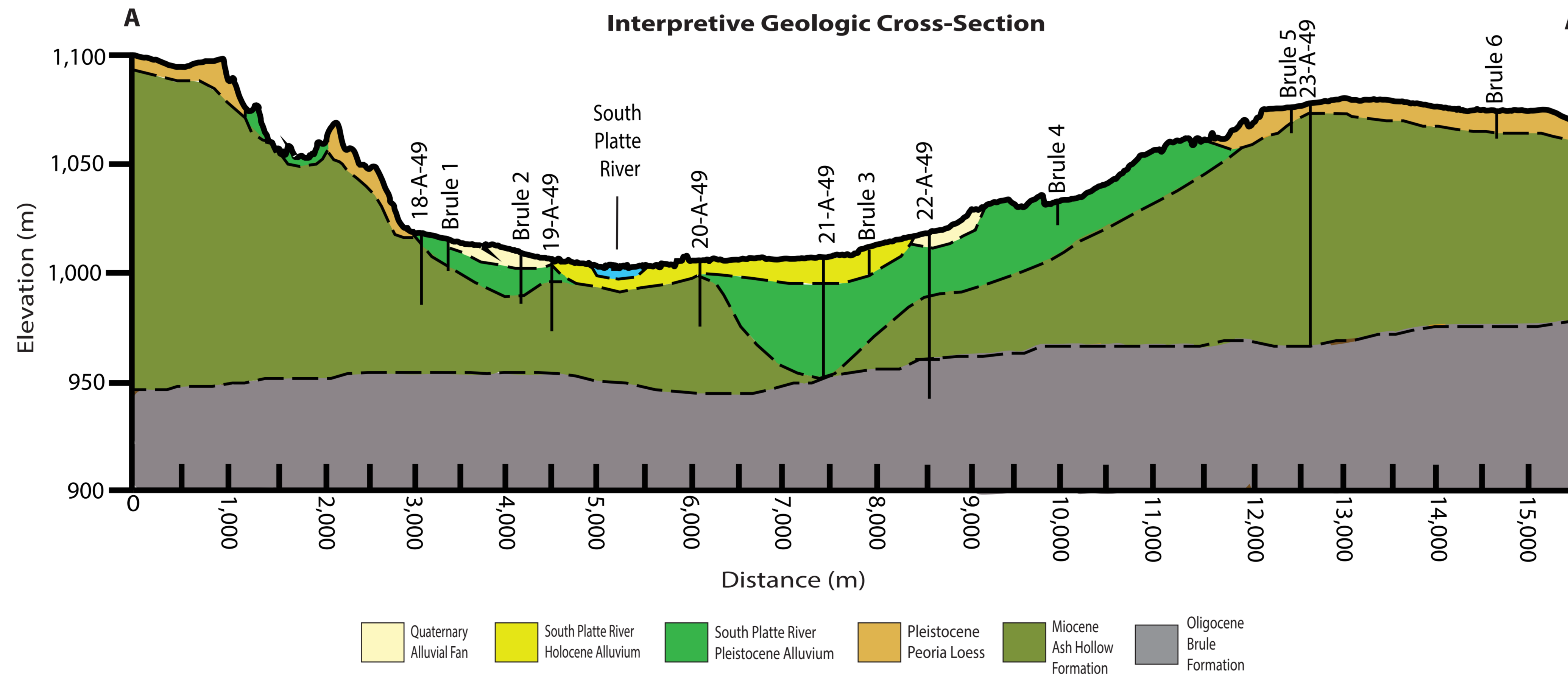


Fig 2. Interpretive geologic cross section from A to A'. Subsurface geology was derived from historic and recent CSD Test Holes.

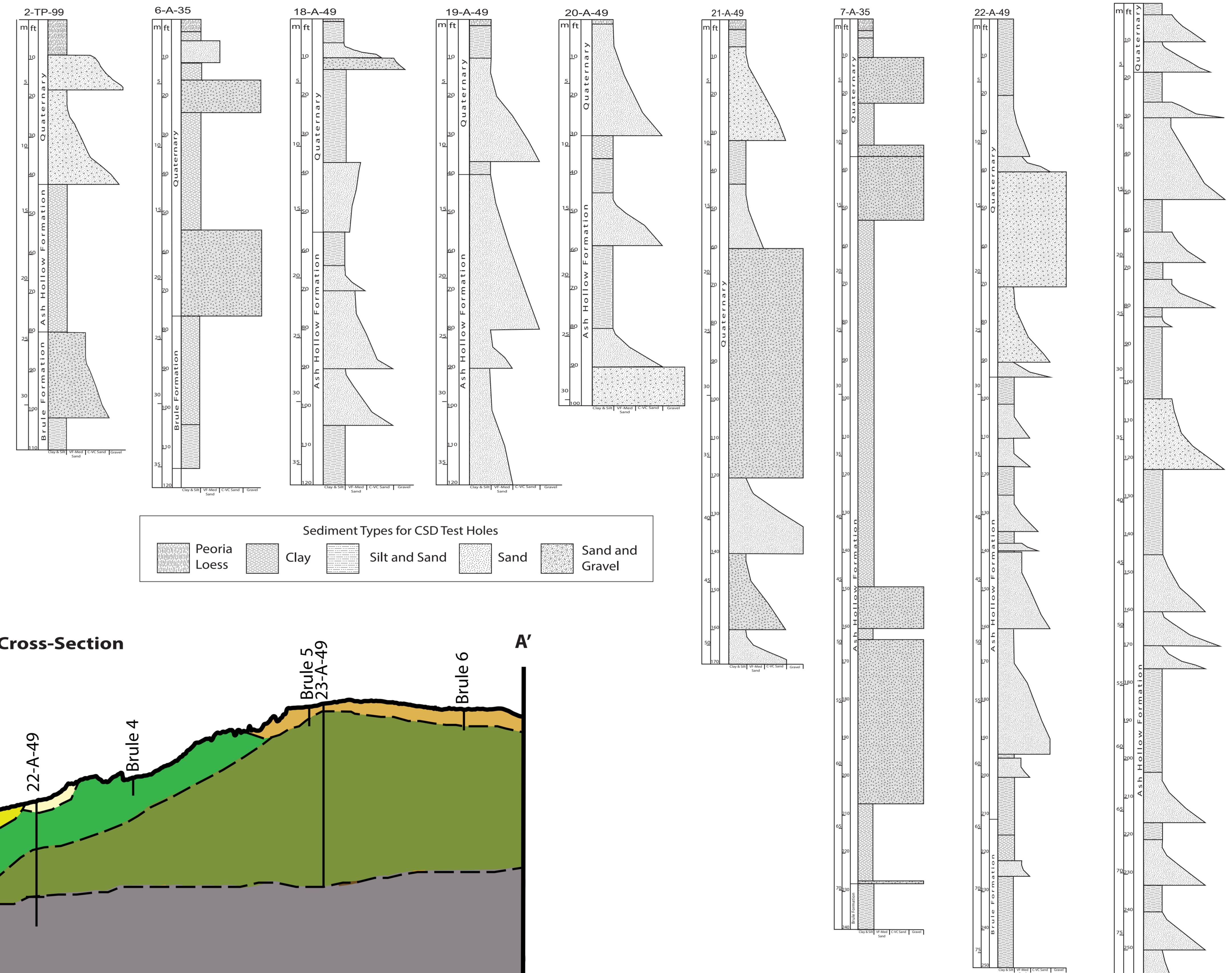
Acknowledgements

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References

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Historic CSD Test Hole Logs



CSD Boreholes Drilled as Part of this Project

