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Richard D. Reger[1] and William A. Petrik[2]

Introduction

The purpose of this investigation is to provide reliable mapping of the surficial geology of the Anchor Point area to aid in the interpretation of the aquifer systems there (Petrik, in press). The surficial geology of the Anchor Point area was mapped by interpretation of 1:65,000-scale, false-color infrared aerial photographs (series ALK 60 CIR, negatives 345-348 and 411-414) taken August 14, 1984. Based on the distribution of landforms, surficial-geologic units were plotted first on acetate overlays of each photograph and then, using an optical transfer scope, were transferred to the 1:25,000-scale base map (sheet 1). A reconnaissance of the study area was conducted September 16 through 18, 1993, for the purposes of verifying the photointerpretation, measuring five key stratigraphic sections (figs. 1-4), and collecting key samples. Subsequently, organic samples were analyzed for their radiocarbon contents in an attempt to date the deposits, and the concentrations of eight major-element oxides in glass shards from three samples of a prominent volcanic ash were measured with an electron microprope to provide the basis for reliable correlation with tephras elsewhere in western Kenai lowland (Reger and Pinney, in press). During the field visit, only general descriptions were made of exposed sediments. Samples were not collected for grain-size analyses, but estimates of the percentage of major textural classes were made in the field.

Geologic setting

The study area is in the southwestern part of the Kenai lowland around the settlement of Anchor Point near the mouth of Anchor River, a clearwater stream that drains the southwestern Caribou Hills (sheet 1). Kenai lowland and Caribou Hills to the east and northeast of Anchor Point are physiographic divisions of the Cook Inlet trough, a large structural basin between the Aleutian Range to the west and the Kenai Mountains to the east. This linear basin contains up to 7 km of sedimentary rocks and sediments that were laid down during the past 30 million years (Kelley, 1985; Kirschner, 1988). This basin fill has been folded and faulted and petroleum, including oil and natural gas, has accumulated in economically significant amounts in structural and stratigraphic traps in the Tertiary rocks (Magoon and others, 1976). Most of the lowland is covered by a discontinuous layer of Quaternary sediments laid down by glaciers of late Pleistocene age, but the upper Caribou Hills, a highland of Tertiary sedimentary rocks, stood above the ice. The Anchor Point area is generally underlain by sediments deposited during the last 120,000 years, although sandstones and associated rocks of the Beluga Formation of late Miocene to

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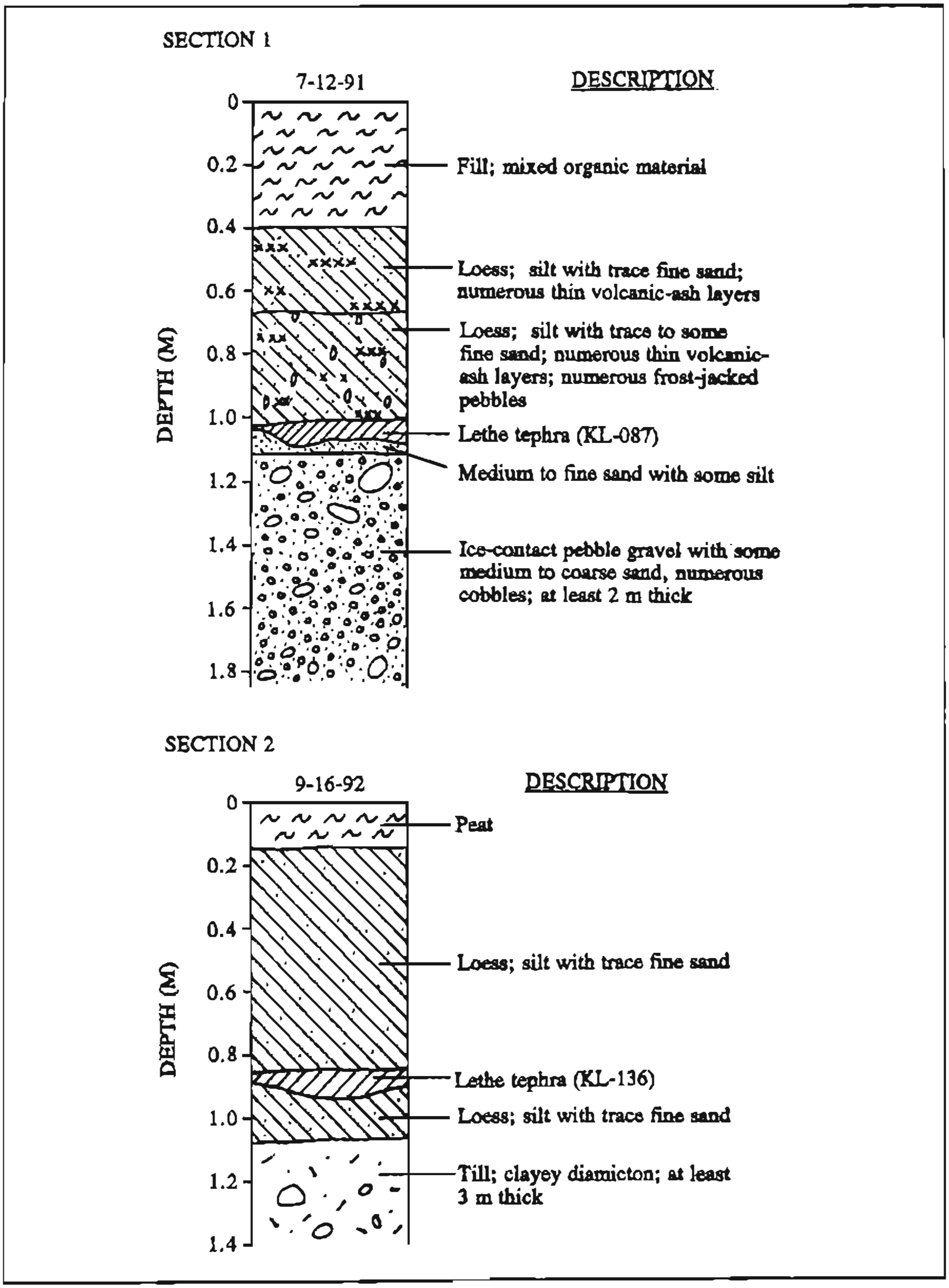

Figure 1. Stratigraphy exposed in Sections 1 and 2, Seldovia C-5 NW Quadrangle, Alaska. See sheet 1 for locations of sections.

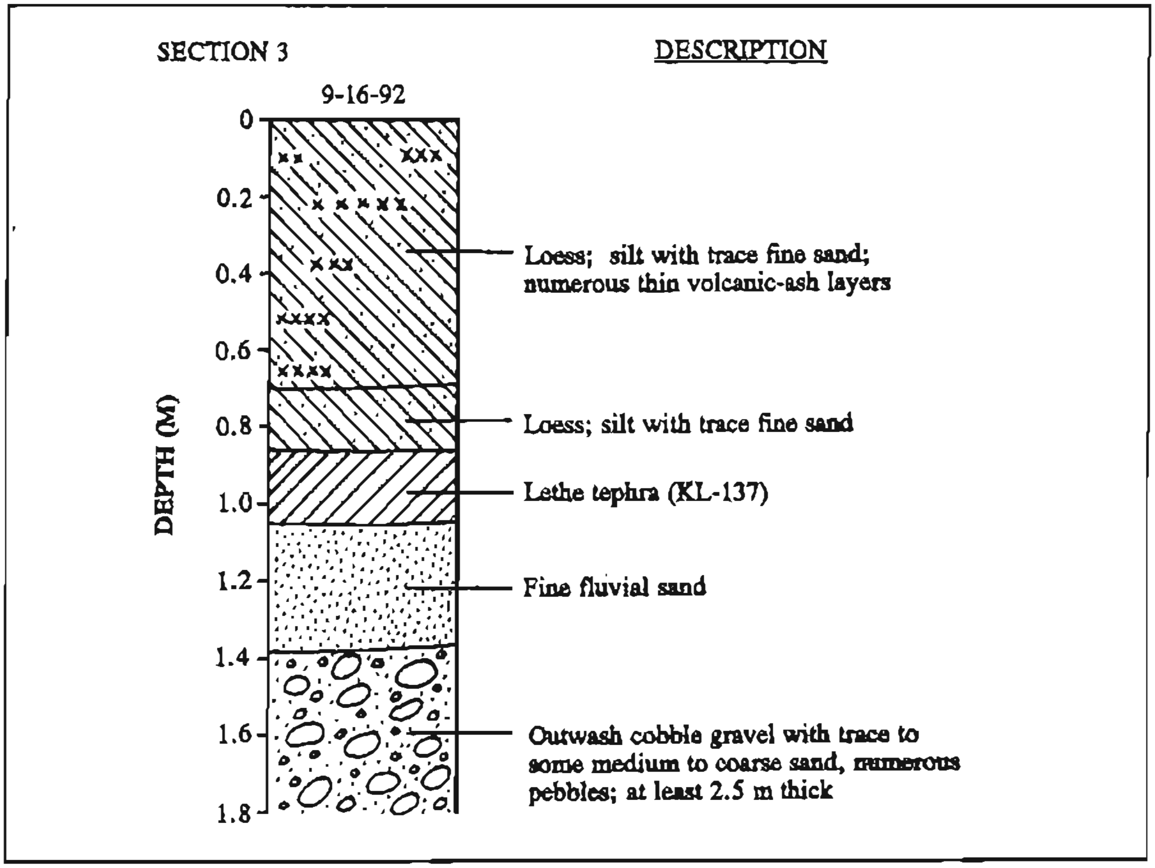

Figure 2. Stratigraphy exposed in Section 3, Seldovia D-5 SW Quadrangle, Alaska. See sheet 1 for location of section.

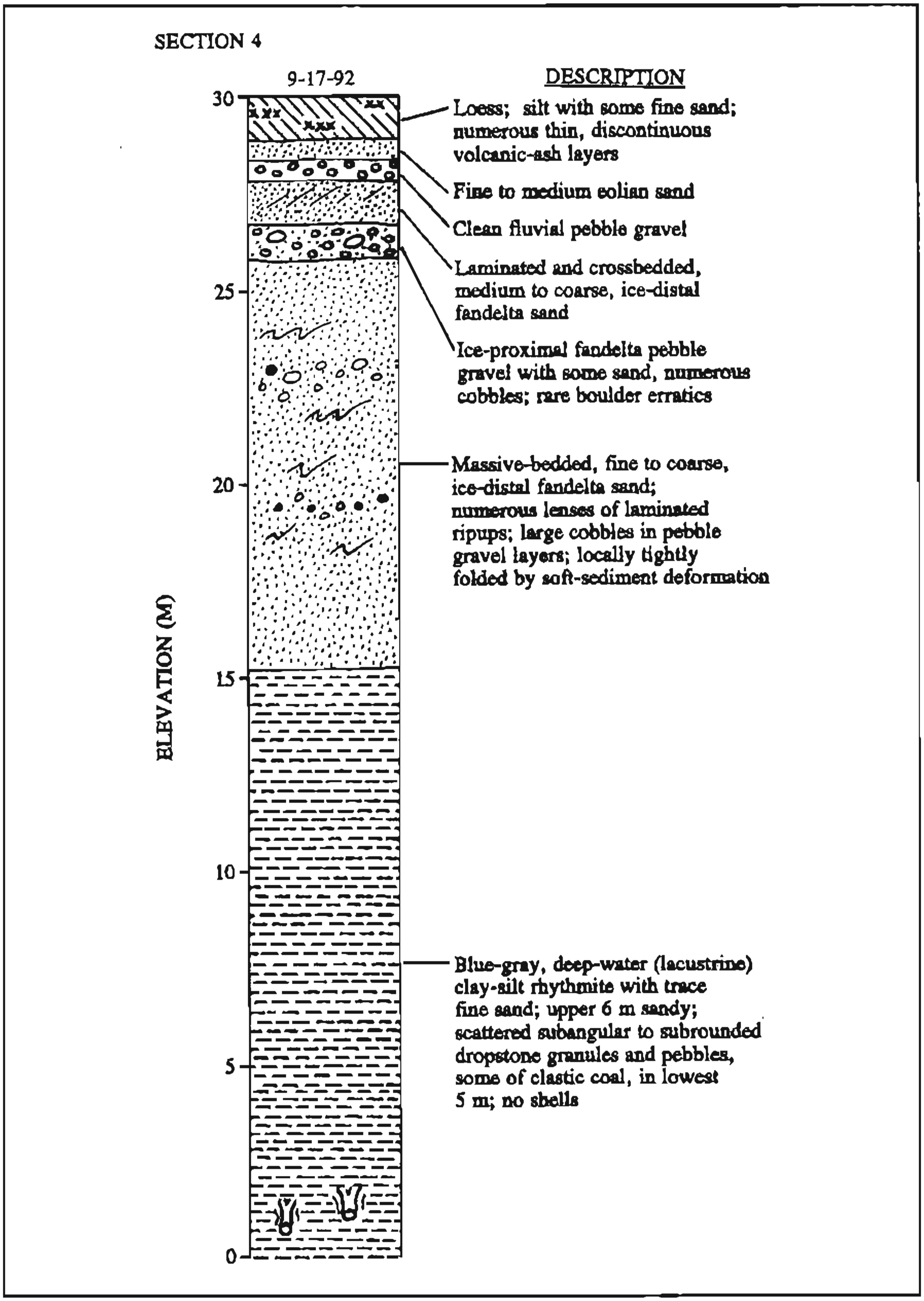

Figure 3. Stratigraphy exposed in Section 4, Seldovia D-5 SW Quadrangle, Alaska. See sheet 1 for location of section.

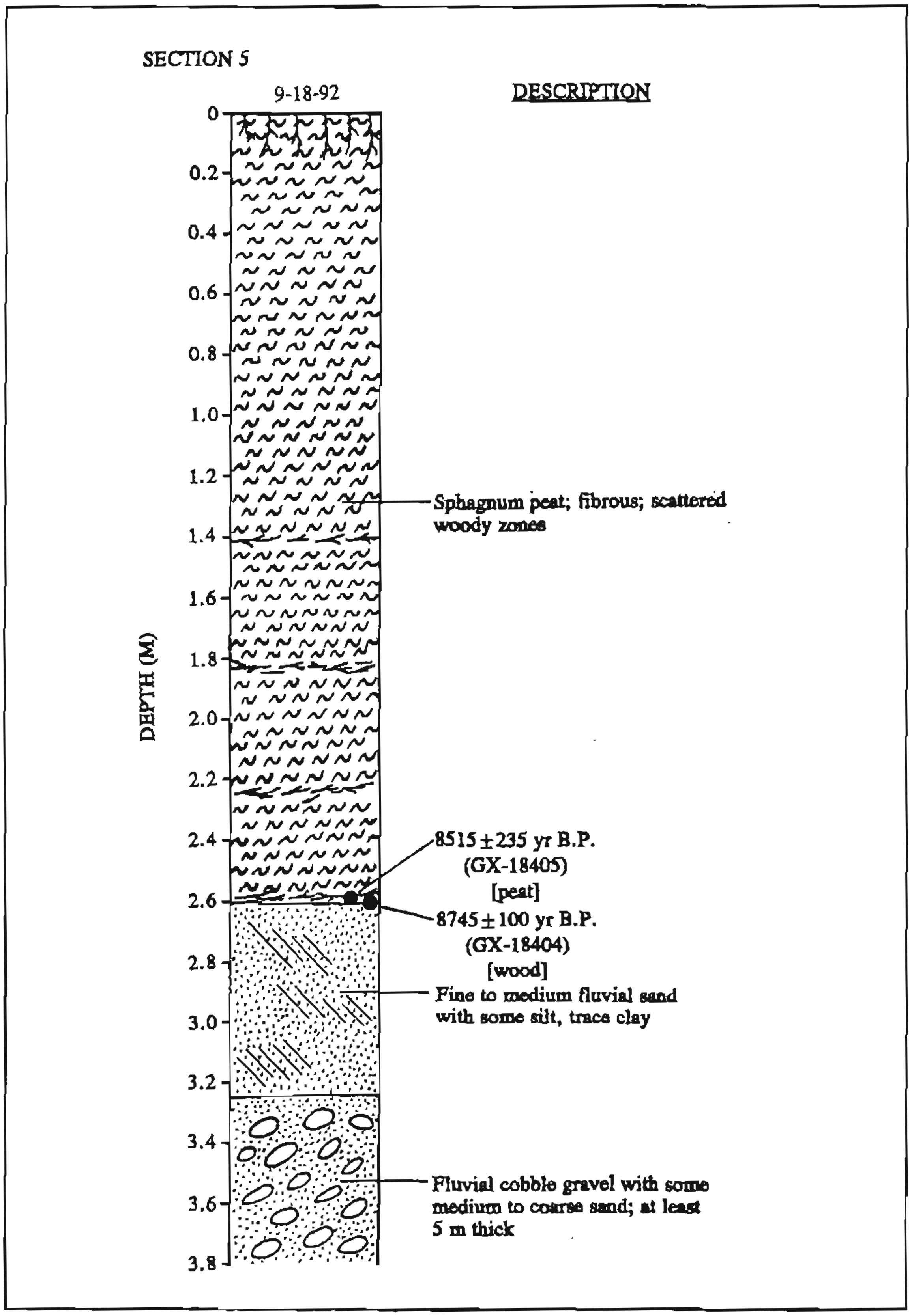

Figure 4. Stratigraphy exposed in Section 5 (Paul Roderick pit), Seldovia D-5 SW Quadrangle, Alaska. See sheet 1 for location of section.

early Pliocene age are present at depth or are exposed in the sea cliff in the southwestern corner of the study area (sheet 1).

The surficial geology of the study area is roughly divided into two parts by the lower Anchor River (sheet 1). North of the river, Kenai lowland is underlain by undifferentiated till of the pre-late Wisconsin (pre-Naptowne) glaciation and complex glaciolacustrine deposits related to the early (Moosehorn) stade of the late Wisconsin (Naptowne) glaciation (Qd_1). In the vicinity of the settlement of Anchor River, study of the logs of water wells allowed separation of a dominantly glaciolacustrine deposit (Qgl) that is apparently related to the Moosehorn stade of the Naptowne glaciation. This terrane is transected by a complex system of abandoned meltwater channels (Qac). Alluvium of fluvial terraces (Qat) was deposited by modern streams as they incised their channels. Paludal deposits (Qs), primarily peat, form broad, generally treeless blankets and channel and basin fills. Undifferentiated colluvium (Qc) forms aprons and fans on steep river and inlet bluffs; debris-flow deposits (Qcd) and mixed colluvium and alluvium (Qcf) occupy erosion gullies. South of Anchor River, the surficial geology is dominantly till with associated coarse-grained ice-stagnation deposits comprising a kettle-rich moraine built during the Moosehorn stade of the Naptowne glaciation (Qd_2). Most of the kettles are occupied by small lakes or contain organic paludal sediments. A rotational slump (Qcl) scallops the steep, rapidly eroding sea cliff just north of the mouth of Traverse Creek in the southwestern corner of the study area (sheet 1).

Summary of late Pleistocene history

The Anchor Point area was glaciated twice during the past 120,000 years (Karlstrom, 1964). The distribution of landforms related to the early major ice advance indicates that the floor of the Cook Inlet trough was inundated by a huge compound glacier that flowed southward into the north Pacific Ocean. Deposits of this inundation underlie the lower slopes of the Caribou Hills east of Anchor Point and underlie the lowland north of Anchor River (sheet 1). A complex, southwest-trending system of meandering stream channels was incised into deposits of the early glaciation by meltwater streams, probably beginning in the recessional phase of the early glaciation. These channels contain up to 15 m of fluvial sand and gravel capped by up to 3 m of peat. The southwest-draining system of former meltwater channels is crosscut by incised drainages, like the North Fork Anchor River, that are graded to Cook Inlet. Retreat of the wave-eroded eastern shore of Cook Inlet has caused these cross drainages to rapidly erode their lower courses. For example, the lower course of North Fork Anchor River is cut 15 to 35 m below the general lowland surface.

The location of the present course of lower Anchor River is a result of stream diversion along the margin of a glacial lobe that advanced northwestward out of Kachemak Bay during the Moosehorn stade of the Naptowne glaciation, an estimated 18,000 to 25,000 years ago (Reger and Pinney, in press). During the Moosehorn stade, the mouth of Cook Inlet was apparently blocked by a large glacier that spread onto the exposed continental shelf from an ice-accumulation center in the Mount Douglas-Four Peaked Mountain area. This ice may have joined with ice from the Kenai Mountains (Karlstrom, 1964), and the resulting ice dam apparently impounded meltwaters that rose to levels with present elevations of about 80 m in the lower Cook Inlet trough (Reger and Pinney, in press, fig. 3). The stratigraphy in Section 4 (fig. 3) is consistent with a northwestward advance by the partially floating Kachemak Bay lobe into this meltwater lake to a line just south of the present mouth of Anchor River, where the glacier stagnated before receding.

The Moosehorn advance out of Kachemak Bay is reliably correlated with coeval advances in the Tustumena Lake trough and the Skilak Lake trough by the presence of the Lethe tephra, a distal fallout volcanic ash of dacitic composition that was explosively erupted from a vent in the Mount Katmai area late in the Killey stade (the advance that follows the Moosehorn advance in the Naptowne chronology of Karlstrom, 1964) (Reger and Pinney, in press). This distinctive tephra was collected from Sections 1 and

2 on top of moraine Qd_2 (fig. 1), confirming that the Qd_2 moraine was built during or before the late Killey stade. Interpretation of well logs in the vicinity of Section 3 (sheet 1) and landforms at the head of Anchor River indicates that lower Anchor River cut through lake sediments to the level of modern sea level during the Moosehorn-Killey interstade, and then 7 m of outwash gravel related to the Killey advance in Kachemak Bay was deposited in lower Anchor River valley (Reger and Pinney, in press, fig. 4). This relation is confirmed by the presence of Lethe tephra in Section 3 on the 8-m terrace at the mouth of Anchor River valley (sheet 1, fig. 2). Since Moosehorn time, wind-borne fine sand, silt, and numerous volcanic ashes from Mount Augustine and other volcanoes across Cook Inlet have accumulatd to form a complex layer of fine-grained surface material. Peat began accumulating in Kenai lowland as early as 13,500 years ago (Karlstrom, 1964). Peat and wood from the base of the 2.6-m-thick peat section in the Paul Roderick pit dated 8515 ± 235 yr B.P. (GX-18405) and 8745 ± 100 yr B.P. (GX-18404), respectively (fig. 4).

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