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GEOLOGIC MATERIALS AND HYDROGEOLOGIC CHARACTERISTICS IN THE FIRE LAKES - EKLUTNA AREA, ANCHORAGE, ALASKA

By
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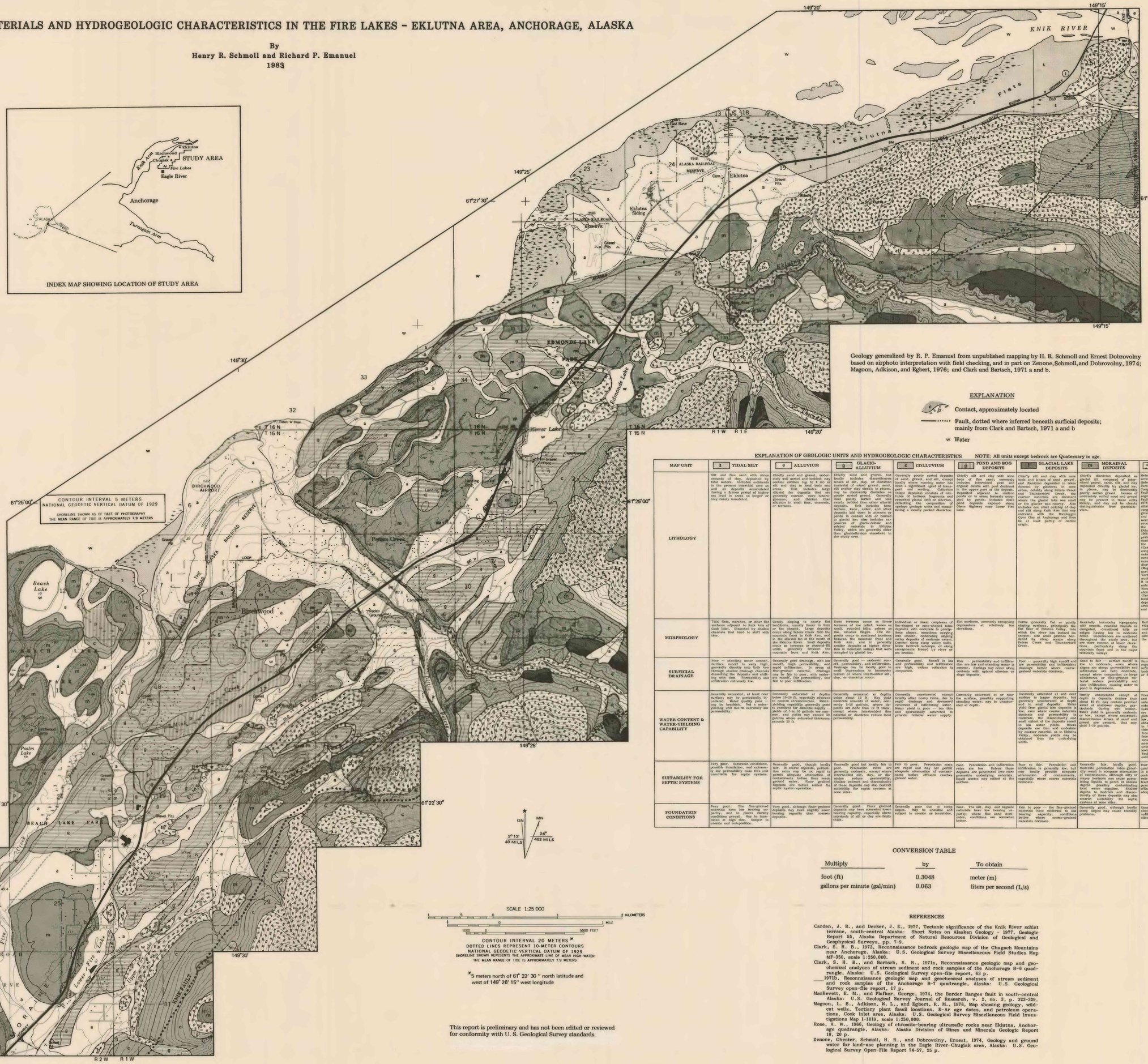
INDEX MAP SHOWING LOCATION OF STUDY AREA



Geology generalized by R. P. Emanuel from unpublished mapping by H. R. Schmoll and Ernest Dobrovolny based on airphoto interpretation with field checking, and in part on Zenone, Schmoll, and Dobrovolny, 1974; Magoon, Adkison, and Egbert, 1976; and Clark and Bartsch, 1971 a and b.

EXPLANATION

Contact, approximately located

Fault, dotted where inferred beneath surficial deposits; mainly from Clark and Bartsch, 1971 a and b

w Water

EXPLANATION OF GEOLOGIC UNITS AND HYDROGEOLOGIC CHARACTERISTICS

NOTE: All units except bedrock are Quaternary in age.

MAP UNIT	s TIDAL SILT	a ALLUVIUM	g GLACIO-ALLUVIUM	c COLLUVIUM	POND AND BOG DEPOSITS	l GLACIAL LAKE DEPOSITS	m MORAINAL DEPOSITS	BEDROCK
LITHOLOGY	Silt and fine sand with minor amounts of clay, deposited by tidal waters. Includes sediments in the present intertidal zone as well as deposits accumulated during a former period of higher sea level in areas no longer or only rarely inundated.	Chiefly sand and gravel, moderately well sorted and well rounded; contains cobbles (up to 8 in) or silt and clay in local beds and areas. Unit includes large alluvial fan deposits that are generally coarser, more heterogeneous, and thicker than alluvium in small fans, channels, or terraces.	Chiefly sand and gravel, but locally includes substantial lenses of silt, clay, or diamicton (material of mixed gravel, sand, silt and/or clay sizes); in places, may be distinctly diamicton or poorly sorted gravel. Generally more poorly sorted and less rounded than alluvial fan deposits. Unit includes kame terrace, kame, esker, and other deposits laid down in streams or ponds in contact with or related to glacial ice; also includes exposures of glacio-colluvial and alluvial deposits in Knik River Valley, which are generally older than glacioalluvium elsewhere in the study area.	Generally poorly sorted deposits of rock fragments and soil; locally where running water has been a significant agent of transport and sorting. Colluvium (slope deposits) consists of mixtures of bedrock fragments and reworked glacial drift or alluvium, reflecting the composition of upslope geologic units and constituting a loosely packed diamicton.	Chiefly silt and clay with some peat; commonly contains organic debris and pond deposits. Includes unnamed pond in Glenn Lake.	Chiefly silt and clay with some beds and lenses of sand, gravel, and diamicton deposited in lakes. Includes deposits in lake areas, notably along Peters Creek and Thunderbird Creek, the coarser materials are dominant where the glacial lake was small or the glacier was nearby. Also includes one small outcrop of clay at Eklutna Flats that may be correlative with the Bootleggers Cove Clay at Anchorage and thus be at least partly of marine origin.	Chiefly diamicton deposited as lodgement till, ablation till, and stoned gravel; sandy and gravelly deposited directly by glacial ice in places, may be distinctly poorly sorted gravel. Lenses of moderately sorted sand and gravel may be present in these units locally, and may not be clearly distinguishable from glaciolacustrine.	Metamorphic and igneous rocks of the Chugach terrane, as defined and dated on this map, including the Jurassic and/or Cretaceous McHugh Complex southeast of the Knik Fault (the name for the local segment of the Border Ranges Fault), MacKevett and Plafker, 1974, and Cretaceous metagraywacke, siltstone, graywacke, schist, and conglomeratic sandstone, and of greenstone associated with chert and argillite (Clark, 1972); northwest of the Knik Fault, rocks of several formations occur including the Jurassic Kamishak Formation (Kalkula Greenstone Complex (Rose, 1966), composed of gyroxenite, peridotite, and serpentinized dunite, and associated gabbro; the Jurassic Knik River Schist (Carden and Decker, 1977), composed of metatite, amphibolite, metaperidotite, metasandstone, and metaconglomerate, and the unnamed Jurassic granodiorite, diorite, quartz diorite formation (Magoon and others, 1976). Also northwest of the Knik Fault, the Tertiary Kenai Group underlies much of the study area, although it is not exposed in the study area. The Kenai Group is composed of siltstone, sandstone, and coal (Zenone and others, 1974). A local mantle of colluvium of glacial deposits may conceal bedrock in areas mapped as bedrock. (Clark and Bartsch, 1971a; 1971b.)
MORPHOLOGY	Tidal flats, marshes, or other flat surfaces adjacent to Knik Arm of Cook Inlet. Dissected by shallow channels that tend to shift with time.	Gently sloping to nearly flat landforms, usually linear in form or fan shaped. Large deposits occur along Peters Creek from the mountain front to Knik Arm, and in the alluvial fan at the mouth of the Eklutna River. Small deposits occur as terraces along streams and as a generally flat area between the mountain front and Knik Arm.	Kame terraces occur as linear terraces of low relief; kames as small, rounded hills; eskers as low, sinuous ridges. The deposits occur in scattered locations between the mountain front and Knik Arm, and in generally smaller segments at higher elevation in mountain valleys that were occupied by glacial ice.	Individual or linear complexes of fan-shaped or cone-shaped talus deposits with moderate to gentle dress slopes; sometimes merging into smooth, moderately sloping valley deposits of moderate extent. Common along steep valley walls, below bedrock outcrops, or along escarpments formed by river or sea erosion.	Flat surfaces, commonly occupying depressions at relatively low elevations.	Forms generally flat or gently sloping surfaces, principally the flat floor of Eklutna Flats along which the river has incised its canyon; also small patches bordered by steep scarps along Peters Creek and Thunderbird Creek.	Generally hummocky topography with smooth, rounded crests or ridges; hummocks commonly 10 to 30 ft high, but local relief may be moderate. Occurrences are scattered throughout the study area, but are more common at lower elevations, particularly along the mountain front and in the major tributary valleys.	Bedrock occurs on steep-sided ridges in the mountainous southeastern part of the study area, and in knobs and small outcrops along steep slopes elsewhere in the study area.
SURFICIAL DRAINAGE	Poor -- standing water common. Surface runoff is very high, generally directly into Knik Arm through shallow drainage channels dissecting the deposits and shifting with time. Permeability and infiltration extremely low.	Generally good drainage, with low runoff, high permeability, and rapid infiltration. In areas of fine-grained material, drainage may be fair to poor, with moderate runoff, fair permeability, and fair to poor infiltration.	Generally good -- moderate runoff, permeability, and infiltration. Drainage may be locally poor in small depressions in hummocky terrain or where interbedded silt, clay, or diamicton occur.	Generally good. Runoff is low and permeability and infiltration are high, unless colluvium is compacted.	Poor -- permeability and infiltration are low and standing water is common. Springs may occur along contacts with upland siltstone or slope deposits.	Poor -- generally high runoff and low permeability and infiltration; drainage better where coarse-grained materials dominate.	Good to fair -- surface runoff is low to moderate, even where slopes are steep; permeability and infiltration are both moderate, except where compaction or large admixtures of fine-grained material reduce permeability and cause standing water to pool in depressions.	Runoff is high where bedrock is exposed, and permeability and infiltration are low, except where bedrock is extensively weathered or fractured.
WATER CONTENT & WATER-YIELDING CAPABILITY	Generally saturated, at least near surface; may be periodically inundated by tidal waters. Water may be brackish. Not a water-yielding unit due to extremely low permeability.	Commonly saturated at depths below 10-20 ft, especially adjacent to streams. Water-yielding capability generally good to excellent for domestic supply -- yields of 5 to 20 gal/min are common, and yields may exceed 50 gal/min where saturated thickness exceeds 20 ft.	Generally saturated at depths below about 10 ft. May yield water to springs or wells at nearly 5-10 gal/min, where deposits are more than 10 ft thick, except where interbedded fine material or diamicton reduce local permeability.	Generally unsaturated except briefly after heavy rains, due to rapid drainage and downward movement of infiltrating water. Low yield is to springs or wells and generally saturated to provide reliable water supply.	Commonly saturated at or near the surface, possibly supporting standing water; may be unsaturated at depth.	Commonly saturated at and near surface in larger deposits, but unsaturated at depth in thin and/or and in small deposits. Water yield from glacial lake deposits is low, even where coarse materials dominate and permeability is moderate; the discontinuity and small extent of the deposits result in a limited supply. Some deposits are thin and underlain by coarser material, as in Eklutna Valley, moderate yields may be obtained from the underlying units.	Locally unsaturated except at depth in deposits thicker than about 40 ft; may contain perched water at shallower depths, particularly where fine-grained. Water yield is generally moderate or low, except where saturated; discontinuous lenses of sand and gravel are present, that may yield 5-10 gal/min.	Fresh bedrock has low porosity and low water content even when saturated. Where bedrock is extensively weathered or fractured, porosity and water content may be higher. Yields of wells completed in bedrock are generally low, 5 gal/min or less, and rarely obtain water from fracture zones in the bedrock. Larger quantities of water may be obtained from wells completed in fractured zones. Where extensively fractured, zones may yield 10 gal/min or more. The Kenai Group, where it underlies surficial units in the lowlands northwest of the Knik Fault, generally yields water more easily than other bedrock units.
SUITABILITY FOR SEPTIC SYSTEMS	Very poor. Saturated conditions, possible inundation, and extremely low permeability make this unit unsuitable for septic systems.	Generally good, though locally fair. In coarse deposits, percolation rates may be too rapid to permit adequate attenuation of contaminants before they reach ground water. Finer grained deposits are better suited for septic system operation.	Generally good but locally fair to poor. Percolation rates are generally moderate, except where interbedded silt, clay, or diamicton reduce permeability. Shallow bedrock and discontinuity of these deposits may also restrict suitability for septic systems at some sites.	Fair to poor. Percolation rates are rapid and may not provide adequate attenuation of contaminants before effluent reaches ground water.	Poor. Percolation and infiltration rates are low. Unless these deposits are penetrated into more permeable underlying materials, liquid wastes may collect at the surface.	Poor to fair. Percolation and infiltration is generally low, but may locally provide adequate attenuation of contaminants, especially where coarse materials dominate.	Generally fair, locally good. Bedrock permeability may generally result in adequate attenuation of contaminants, although silty or clayey horizons may cause percolating liquids to perch at shallow depths possibly contaminating wells or springs. Shallow depths to bedrock and discontinuity of these deposits may restrict suitability for septic systems at some sites.	Generally good, although locally steep slopes and excessive slopes may cause stability problems.
FOUNDATION CONDITIONS	Very poor. The fine-grained materials have low bearing capacity, and in places marshy conditions prevail. May be inundated at high tide. Subject to erosion and foreposition.	Very good, although finer-grained deposits may have slightly lower bearing capacity than coarser deposits.	Generally good. Finer grained deposits may have somewhat lower bearing capacity, especially where interbeds of silt or clay are fairly thick.	Generally poor due to steep slopes. May be unstable and subject to erosion or landslides.	Poor. The silt, clay, and organic materials have low bearing capacity; where fine sand dominates, conditions are somewhat better.	Fair to poor -- the fine-grained materials have moderate to low bearing capacity; conditions better where coarse-grained material dominate.	Generally good, although locally steep slopes may cause stability problems.	Generally good, although steep slopes and excessive slopes may suffer from rockfalls and landslides.

CONVERSION TABLE

Multiply	by	To obtain
foot (ft)	0.3048	meter (m)
gallons per minute (gal/min)	0.063	liters per second (L/s)

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This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards.

Base from U. S. Geological Survey, Anchorage B-6 NW, B-7 NW, B-7 SW, and B-7 NE, all 1:25,000, 1979.