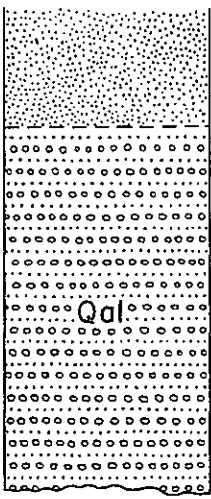
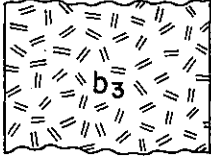
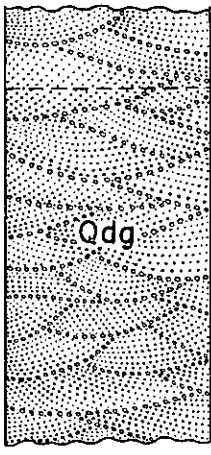
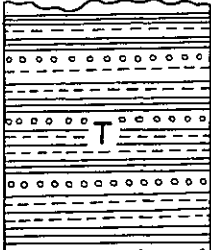
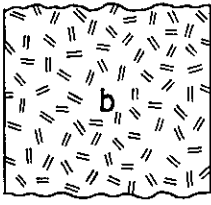
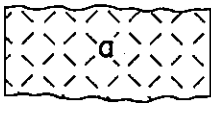

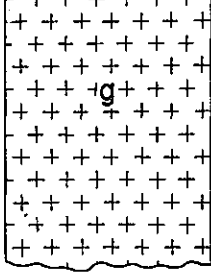
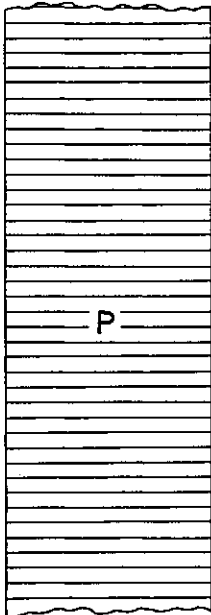
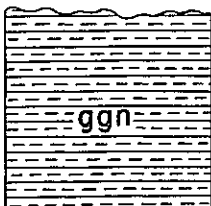


GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

AGE	ROCK UNIT (No proper names)	LITHOLOGY; THICKNESS WHERE KNOWN	REMARKS
QUATERNARY	Alluvial bed	 <p><i>Aeolian deposits (sand)</i></p> <p><i>Terrestrial deposit (sand, gravel, clay)</i></p>	<p>ALLUVIAL BED can be divided as follows:</p> <div style="margin-left: 40px;"> <p>Alluvial bed</p> <ul style="list-style-type: none"> aeolian deposits terrestrial deposits <ul style="list-style-type: none"> terrace gravel bed plain gravel bed river bed deposits </div> <p>The aeolian deposits are widely distributed throughout North Manchuria. In the area of this map, these deposits are found only in the southwest corner (north of Tung-yang-chen [東陽鎮]).</p> <p>The terrace gravel bed extends from Pu-hsi [布西] eastward for more than 40 km along the northern bank of the No-mo-erh Ho [諾爾河]. Its relative height is 10 m in the vicinity of Pu-hsi and about 4 m to 5 m in the southern part of No-ho [納河] (town).</p> <p>The plain gravel bed lies 5 m to 10 m beneath the sand prevailing throughout the drainage of the Nen Chiang [嫩江]. In the adjacent map area to the south, the plain gravel bed is about 10 m to 40 m thick, rests upon the PLEISTOCENE BED, and is composed of well-worn pebbles of quartz, porphyrite, granite, basalt, and porphyry.</p> <p>The river bed deposits are sands and gravels composed mainly of andesite, basalt, clay slate, and agate.</p>
	Quaternary basalt	 <p><i>Olivine basalt, 50-100m thick at Tung-ching-lung-kang (東青龍崗)</i></p>	<p>The QUATERNARY BASALT is found at several places in the eastern part of this map area and overlies the PLEISTOCENE BED and the TERTIARY FORMATION. It is black to gray in color, vesicular to dense and compact, and contains olivine phenocrysts in places.</p>
	Pleistocene beds	 <p><i>Upper bed of sand, gravel, clay; predominantly sand and clay; 7m thick at Ko-shan (克山)</i></p> <p><i>Lower bed of sand, gravel, clay; predominantly gravel; 70m thick at Ko-shan (克山)</i></p>	<p>The PLEISTOCENE BED occupies most of the map area, rests upon the TERTIARY FORMATION, the GRANITE, and the TERTIARY BASALT. The bed can be divided into the Upper and the Lower bed.</p> <p>The Upper bed is composed mainly of sand and clay and is about 7 m to 11 m thick at Ko-shan [克山].</p> <p>The Lower bed is composed mainly of sand and gravel, and in the area northwest of No-ho it is composed of an alternation of sand, gravel, and clay. The sands are mostly medium- to coarse-grained white or yellow quartz sands. The gravels are quartz, agate, rhyolite, and granite gravels of hen's egg size. Some of the clay is like a hard shale or bentonite. The Lower bed is about 70 m thick in the vicinity of Ko-shan. At Pu-hsi, the Lower bed overlies the cut-terrace of TERTIARY BASALT flows, is thick to the north and thin to the south, and is composed mainly of gravel-bearing sand beds displaying a remarkable cross-bedding structure. The gravels are rhyolite and are about 3 cm in diameter.</p>
	Tertiary formation	 <p><i>Alternation of gravel, clayey shale, sand, and bentonite-like clay; no fossils; approximately 100m thick at Tu-mo-ko Shan (完莫閣山)</i></p>	<p>The TERTIARY FORMATION in the map area was formerly treated as a Pleistocene bed in the "Geological and geographical description of Northern Manchuria". Later, parts of it were correlated with the Tertiary formation as shown in the "Geologic map of Manchuria". The TERTIARY FORMATION seems to be mainly composed of an alternation of gravel, sand, and clay intercalating with bentonite-like shale, which may be correlated with the Tertiary rocks along the Hei-lung Chiang [黑龍江].</p>
	Tertiary basalt	 <p><i>Augite basalt; approximately 100m thick along the Nen Chiang (嫩江)</i></p>	<p>The TERTIARY BASALT is widely distributed on the Pu-hsi upheaval peneplain along both banks of the Nen Chiang in the northwestern part of the map area. It overlies the rock formations older than the RHYOLITE, and is overlain by the TERTIARY FORMATION and the PLEISTOCENE BED. The rock is dark gray to black in color, hard and compact or vesicular, and more or less coarse-grained in texture. The vesicular basalt bears much chalcocony of hen's egg to fist size. Under the microscope, the rock is augite basalt consisting of a common augite and oligoclase phenocryst and a groundmass of plagioclase; the augite and plagioclase have an ophitic texture.</p>
MESOZOIC (?)	Andesite		<p>The ANDESITE northwest of Hua-li-hsiao [花力角] has a well defined flow structure and contains macroscopic phenocrysts of biotite and hornblende. The ANDESITE about 25 km north of Hua-li-hsiao (outside of this map area) is covered by basalt.</p>
	Rhyolite		<p>The RHYOLITE is found in the vicinity of To-hsi-chen [多西陳] along the Nen Chiang. It is fine-grained, compact in texture, gray in color, and contains phenocrysts of plagioclase. This rock appears to be the marginal facies of the GRANITE.</p>
	Granite	 <p><i>Biotite granite</i></p>	<p>The GRANITE prevails in the northwestern part of the map area and forms the Pu-hsi peneplain. It is a gray biotite granite containing plagioclase, microcline, and large phenocrysts of feldspar (orthoclase?) 2 cm long. The GRANITE metamorphosed the CLAY SLATE slightly, changing it to a "knotty" biotite slate, or a schist. In places the CLAY SLATE passes completely into a fine-grained compact rhyolitic rock. The GRANITE was considered to be Archean by the Chinese geologists, Messrs. Hsi-chou Tan and Heng-sheng Wang, in 1929. It is probably younger, however, because it metamorphosed the CLAY SLATE (age unknown, perhaps Paleozoic). The GRANITE's field relations plus its porphyritic texture indicate that it cooled slowly before breaking through the CLAY SLATE to the surface, after which it crystallized rapidly and formed the large phenocrysts.</p>
PALEOZOIC (?)	Clay slate	 <p><i>Clay slate, in places schistose, contact metamorphosed in some areas; 1 km thick at Chi-chia-tzu (七家子)</i></p>	<p>The CLAY SLATE is exposed north of Chi-chia-tzu [七家子] and Kuo-ni [郭泥] along the Nen Chiang. The exposure near Chi-chia-tzu has been intruded and altered by the GRANITE and is a sort of "knotty" biotite slate.</p> <p>The other CLAY SLATE exposure north of Kuo-ni has a phyllitic texture and has been intruded, in sill form, by quartz porphyry derived probably from the granite magma.</p>
	Granite gneiss	 <p><i>Granite gneiss, generally biotite-rich; accompanied in places by schists</i></p>	<p>The GNEISS west of Erh-ko-chien [二克陳] and Hua-li-hsiao along the Nen Chiang is covered by the basalt flow and is a biotite granite-gneiss texturally although it is accompanied by crystalline schists. The one at Po-pien [博編] or Po-lun [博倫] is exposed as an island in the alluvial plain and is of biotite granite-gneiss with a well defined gneissic texture.</p>
PRE-SINIAN		<p>(Column not drawn to scale)</p>	

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