GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN
CENOZOIC	Alluvium	Qal — Clay, sand and gravel; thickness not known
	UNCONFORMITY	
	Diluvium	Qdg — Loessic sand, gravel, fine sand, and clay; thickness about 30 m or less.
	Neogene basalt	Nb —
	UNCONFORMITY	
	Paleogene formation	Tl — Shale, clay and coal; total thickness more than 1,400 m
	UNCONFORMITY	
MESOZOIC — Jurassic-Cretaceous	Rhyolite	Rh —
MESOZOIC — Triassic(?)	Triassic(?) granite	gr — Biotite granite and hornblende granite
	INTRUSIVE CONTACT	
PALEOZOIC — Permo-Carboniferous	Chilin formation	Pu — Sandstone and hornfels; thickness unknown
	UNCONFORMITY	
PRECAMBRIAN	Precambrian schist	PCsch — Chlorite schist and sericite schist

(Column not drawn to scale)

Alluvium consists of fluviatile deposits of clay, sand, and gravel, and is widely distributed along such rivers as the Sung-hua Chiang[松花江], Ch'ia-ch'a Ho[卡盆河], La-lin Ho[拉林河], Ch'i-lang Ho[溴浪河], Chu-ch'i Ho[珠琦河], Mo-ni Ho[莫泥河], Hsiao-wei-sha Ho[小韋沙河], Hsiao-ni Ho[小泥河] and Ta-ni Ho[大泥河]. The thickness is unknown.

Diluvium consists of fluvio-lacustrine deposits, chiefly of loessic sand and gravel, rarely intercalated with fine sand and clay, and is distributed in the old great basin along the drainage of the Sung-hua Chiang. The thickness is more than 30 m at the Sung-hua Chiang railway bridge in the Nung-an sheet (NL 51-12) adjacent on the west.

Neogene basalt intrudes the Paleogene formation, and constitutes small cones or wide flows, and is covered by the Diluvium.

The **Paleogene formation** in this map area is called the Shulan[舒蘭] group. It is zonally distributed in a northeasterly direction with a length of 125 km. It is 10 km wide at the southwest end and 30 km wide at the northeast end. The Shulan group was once correlated with the Cretaceous Chuantou[泉頭] formation. However, the following plant fossils of the Paleogene were collected from the sandstone and shale which constitute the hanging wall of the coal seams, by Suteichi NAGAO and Shinzō SATŌ (refer to IMAIZUMI, 1954), and later by Seidō ENDŌ (1940): Acer arcticum Heer, Sequoia sp. (cfr. Sequoia chinensis Endo), Carpinus sp., Cinnamomum Scheuchzeri Heer, and Cyperites sp. The formation is faulted along a northeastern direction against the Carboniferous Chilin formation and against the granite (g_2) where the granite intrudes the formation. The formation can divided into the following three parts:

(1) Basal conglomerate, 500 m thick, composed of arkose and alternating sandstone and conglomerate.
(2) Coal-bearing beds, 700 to 800 m thick, composed of an alternation of sandy shale and shale, intercalated with clay and coal.
(3) Gray shale, over 200 m thick, composed of shale and clay.

The structure is rather complicated. In the Shu-lan area, three synclines and two anticlines occur, with their axes generally striking N 20 to 80° E and dipping 10 to 30° NW. The coal-bearing beds extend for 35 km, and 26 coal seams (4 m in total thickness) are found at Ch'ien-yao-t'un[前窯屯], 20 coal seams (12 m in total thickness) at Mei-yao-kou[煤窯溝] and 20 to 30 coal seams (20 m in total thickness) at Pan-tui-kou*[拌槌溝] about 5 km southwest of Shu-lan-chieh[舒蘭街]. Although the correlation of coal seams is difficult due to lack of key beds, all coal seams may be classified into three groups, lower, middle and upper. The probable reserves of coal were estimated at 74 million tons and the possible reserves at about 179 million tons. The results of chemical analyses of the coal are as follows (in percent): moisture, 8.65 to 11.22; volatile matter, 35.05 to 38.27; fixed carbon, 21.07 to 33.49; ash, 12.25 to 37.65; sulphur, 0.38 to 0.70; color of ash, light brown; coking property, non-coking; specific gravity, 1.41.

Rhyolite intrudes the Paleozoic formation or is covered by diluvium, and is poorly exposed at the southwestern part of the map area.

Granite occupies much of the southeastern part of the map area. It intrudes the Permo-Carboniferous Chilin formation or is covered unconformably by, or is faulted against, the Tertiary formation. The granite comprises biotite granite and hornblende granite. The biotite granite is medium- to coarse-grained holocrystalline in texture, and consists chiefly of quartz, orthoclase, microcline, oligoclase and biotite, accompanied by accessory minerals such as apatite, magnetite and zircon. The hornblende granite is a marginal facies of the biotite granite; it is light grayish pink and is fine- to medium-grained in texture.

The **Permo-Carboniferous formation** in the map area is an extension of the Chilin formation which is widely distributed in the Chi-lin map area (Chi-lin sheet, NK 52-1) adjacent on the south. It consists chiefly of metamorphosed sandstone and hornfels. The formation strikes N 60° E and dips 50° SE at Yin-kuan-tun[銀鑵屯].

The **schist** comprises chlorite schist and sericite schist; being unconformably overlain by the Permo-Carboniferous formation, it may be Proterozoic in age. The schist strikes N 75° E and dips 70° SE at Shui-chu-liu-kang-kuan-chieh[水曲柳崗官街].

* Not shown on the map.

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