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METALLOGENY OF THE TOLOVANA MINING DISTRICT, EAST-CENTRAL ALASKA

By

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Geological and Geophysical Surveys

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The Tolovana mining district is centered near the town of Livengood, approximately 70 miles northwest of Fairbanks, in east-central Alaska. Figure 1 is a simplified geologic map of the area surrounding Livengood.

Bedrock exposed in the region is dominated by a complexly deformed sequence that ranges in age from Cambrian to Cretaceous. This sequence, although tectonically dismembered, has close affinities to rocks of the Selwyn Basin and Cassiar Platform in eastern and central Yukon Territory, Canada (Chapman and others, 1980, Robinson and others, 1983, and Tempelman - Kluit, 1984).

The oldest rocks in the Livengood area (the Grit unit) comprise an interlayered sequence of maroon and green slate, black slate, dark gray limestone, vitreous quartzite and bimodal quartz sandstone (grit). The green slate of this unit contains the trace fossil Oldhamia and has been assigned an Early Cambrian age (Churkin and Brabb, 1965). Similar rocks in the Yukon Territory are included in the Grit Unit of Gabrielse and others (1973) and are believed to floor the Selwyn Basin and Cassiar Platform (Tempelman - Kluit, 1984). Southeast of Livengood, rocks of the Grit unit are apparently thrust over a Cambro-Ordovician sequence of sheared volcanics quartzites and slate, that are considered to be equivalent to the Fossil Creek Volcanics in the White Mountains and of Early Ordovician age (Bundtzen, 1983, and Chapman and others, 1971).

Above the Cambro-Ordovician sequence is a unit of Ordovician to Silurian age composed of variegated chert and shale, gray chert, dolomitic limestone and minor felsic tuff and greenstone. This unit, the Chert terrane of Robinson and others (1983) includes the lower Ordovician Livengood Dome Chert of Chapman and

others (1980) and is equivalent to the Road River Formation in the Yukon Territory (Chapman and others, 1980, Robinson and others, 1983, and Tempelman - Kluit, 1984).

Next, a rock sequence dominated by interlayered clastic sediments and gray chert of Paleozoic age that may be equivilent to rocks of the Earn Group in the Yukon (Robinson and others, 1983, Tempelman - Kluit, 1984), is apparently transitional between rocks of the Chert terrane and an overlying sequence of clastic turbidites of Middle and Upper Devonian age.

Associated with the Devonian sequence near Livengood is a dismembered and tectonically mixed mafic-ultramafic complex that includes gabbro, diorite, and serpentinite.

North of Livengood the Rampart Group of Mississippian to Triassic age is present and consists of a heterogenous mixture of gabbro, pillow basalt, diorite, chert, conglomerate, sandstone, and shale (Brosgé and others, 1969). The Rampart Group may be equivalent to the Circle Volcanics of eastern Alaska and is juxtaposed against the older rocks near Livengood along what is probably a faulted unconformity (Robinson and others, 1983).

South of Livengood a thick sequence of thin bedded, interlayered sandstone, shale and conglomerate of Jurassic to Cretaceous age, (Mesozoic flysch unit of Robinson and others, 1983) unconformably or structurally overlies rocks of the Devonian clastic unit and rocks of the Cambro-Ordovician unit.

Felsic to intermediate plutons of Tertiary or Late Cretaceous age intrude the Devonian clastic unit near Livengood and the Mesozoic flysch south of Livengood.

Although tectonically dismembered, detailed mapping and stratigraphic reconstructions in the region (Figure 2) suggest that the stratigraphic succession from the Cambrian through the Devonian is continuous and probably represents the western continuation of the Selwyn Basin in Alaska (Robinson and

others, 1983, and Tempelman - Kluit, 1984, Robinson, 1983, Smith, 1983, Bundtzen, 1983, and Albanese, 1983b), thus the metallogeny of the Livengood area may also be similiar to that of the Selwyn Basin.

Gold placer deposits in the Livengood area have produced over 375,000 ounces of gold since their discovery in 1914. The most productive creeks in the area are centered in the Money Knob and Amy Dome areas, east of Livengood and on Livengood Creek, north and west of the Livengood townsite. Gold lode deposits in the Livengood area consist of small gold-antimony-quartz veins and mineralized felsic dikes that intrude the Mesozoic flysch and Devonian clastic unit and contain gold concentrations that range from 1.0 to 5.0 ppm (Robinson and others, 1983, Allegro, 1984, and Albanese, 1983a).

Zones of pyritic massive sulfide are present in rocks of the Paleozoic clastic and chert unit (Earn Group) north of Livengood. The zones contain very low base metal values however, their presence suggests a permissive environment for syngenetic metal concentrations in these rocks.

Rocks of the Chert terrane (Road River Formation) northwest of Livengood, are the host to stratabound limonitic chert breccia horizons that contain gold concentration on the order of 1.0 to 1.3 ppm. The origin of these mineralized zones is unknown, at present; they may represent either epigenetic mineralization or sygenetic, exhalitive deposits (Robinson and others, 1983).

Near Mt. Schwatka, northeast of Livengood, rocks of the Chert terrane contain zones of massive smithsonite ($ZnCO_3$), hosted in silicified carbonate. The zinc mineralization may represent remobilized primary syngenetic zinc concentrations in rocks equivalent to the Road River Formation in Selwyn Basin, and therefore carries significant implications concerning the regional metallogeny and mineral potential of these rocks.

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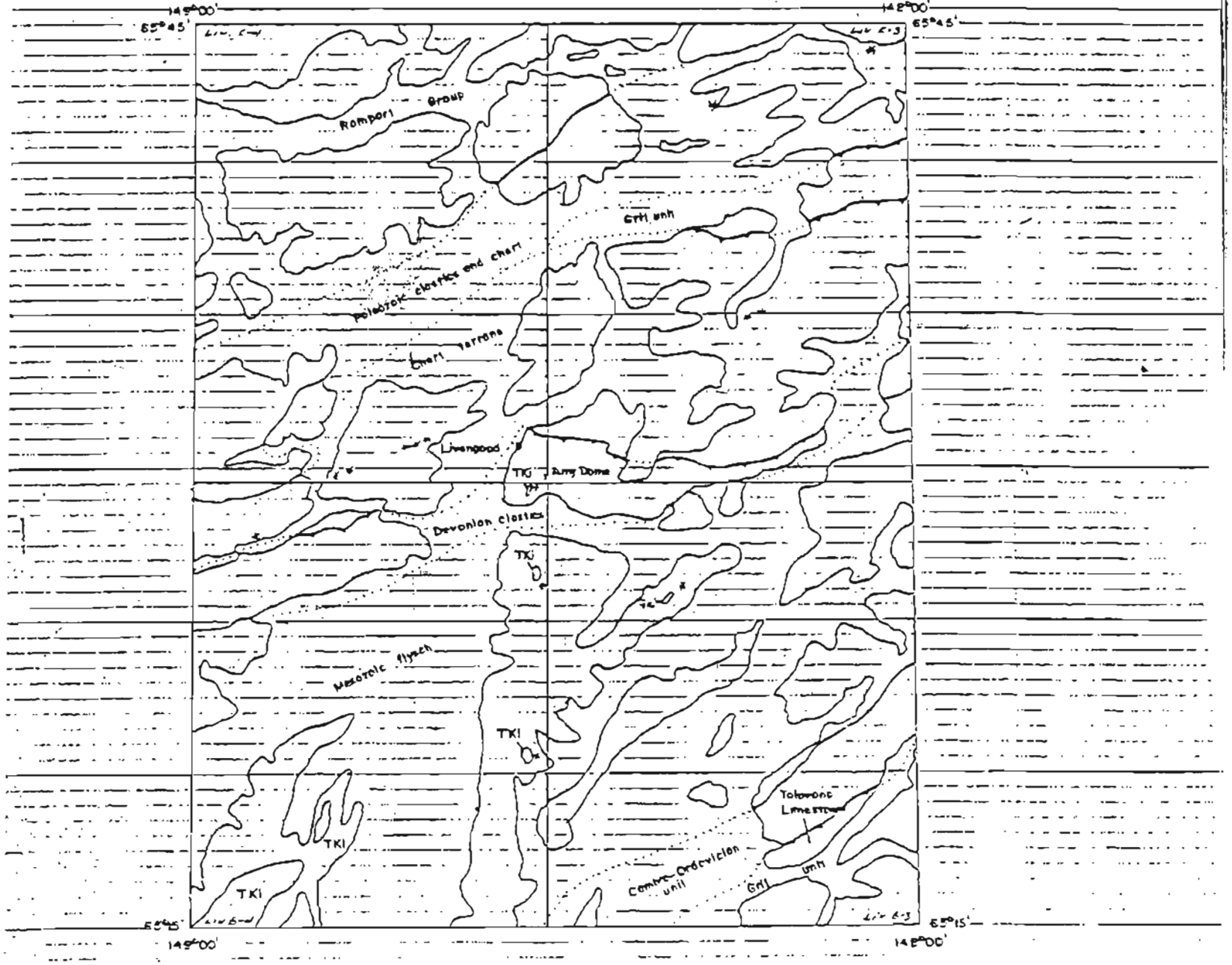

Figure 1. Simplified geologic map of the Livengood area (from Robinson, 1983; Smith, 1983; Bundtzen, 1983; Albanese, 1983; and Chapman and others, 1971)
* Indicates metal concentrations discussed in the text

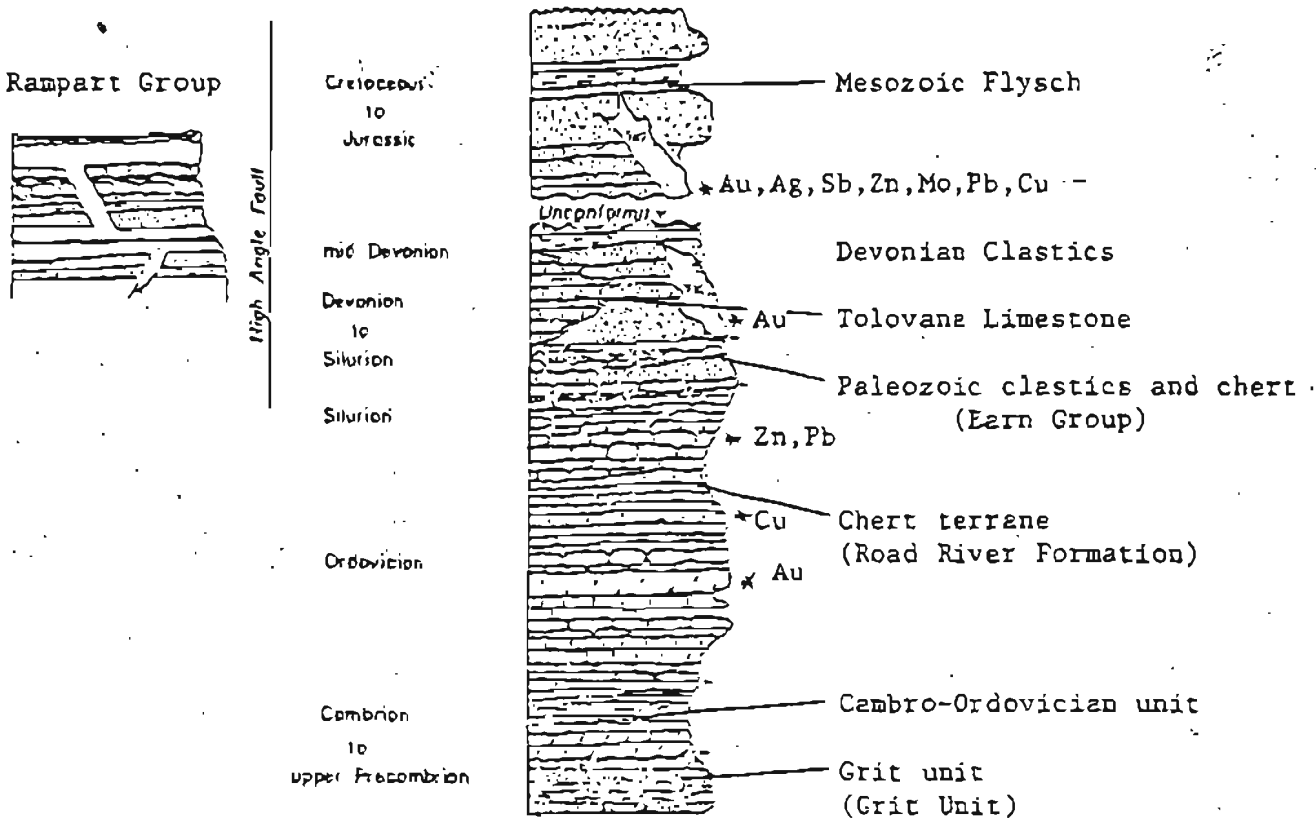

Figure 2. Restored stratigraphic section in the Livengood area, showing correlatable rock units in the Yukon Territory, Canada, and known metal concentrations within the stratigraphic package.