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DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

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GEOLOGY OF THE SCRAFFORD ANTIMONY-GOLD LODE DEPOSIT, FAIRBANKS MINING DISTRICT, ALASKA

By
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INTRODUCTION

This prospect examination is part of an ongoing study of mineral deposits in the Fairbanks mining district of interior Alaska, in cooperation with the Mineral Industry Research Laboratory, University of Alaska, Fairbanks. The authors spent 3 days mapping and sampling several trenches on the Scrafford property. A brunton and tape traverse at a scale of 1 in. = 10 ft was used as the principal survey method.

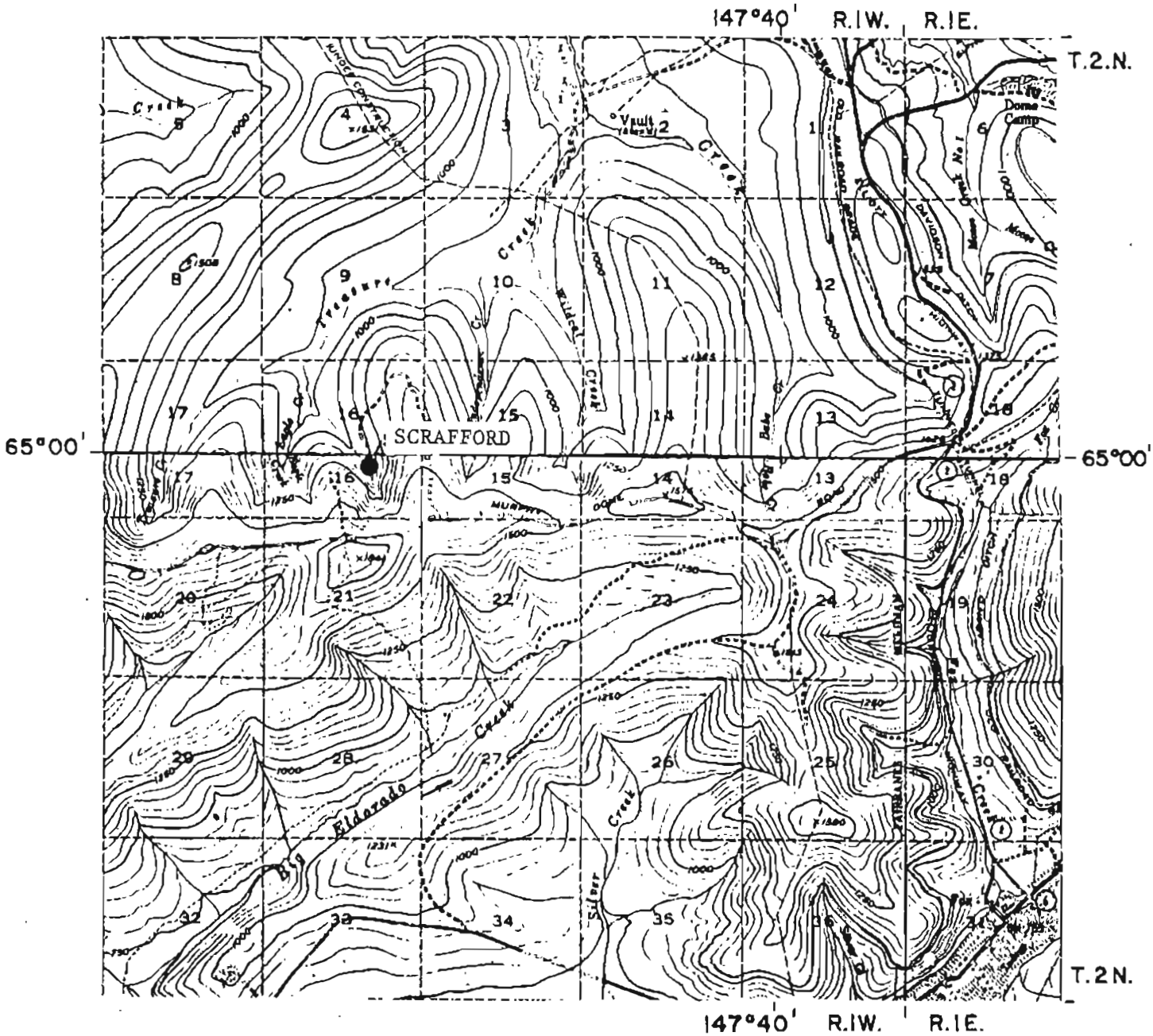
The Scrafford property is located 11 mi north of Fairbanks in T. 2 N., R. 1 W., Fairbanks Meridian. Access to the property is via the Steese and Elliott Highways and along the old Murphy Dome Road to the prospect site (fig. 1).

HISTORY AND PRODUCTION

The Scrafford, or Treasure Creek mine, has been the second largest producer of antimony in Alaska. Extrapolating from a variety of sources (table 1), total production is at least 2,077,920 lbs of antimony from 2,761 tons of selected ore. Unfortunately, no underground or surface mine maps are available for pre-1971 work. Furthermore, specific production figures for that period are incomplete, and thus the figures in table 1 should be regarded as estimates.

Smith (1913) first described the property as an unnamed antimony lode near the headward reaches of Treasure Creek. From 1915 to 1918, E.L. Scrafford leased the property from the original owner, E. Quinn, and mined it by both open-cut and underground methods. According to Hill (1933, p. 156), lessee R.C. Woods drove 300 ft of development workings in 1926 and shipped a large amount of high-grade ore. However, no record of Alaskan antimony production exists in U.S. Geological Survey, U.S. Bureau of Mines, or Territorial Department of Mines records for 1926, and only a small amount of ore was produced in 1927. In the early 1930s, lessee E.R. Pilgrim sluiced mine tailings, colluvium, and nearby stream gravels downslope from the mineralized zone and recovered some high-grade ore for shipment.

There is no record of production from the Scrafford property during World War II or the Korean War, even though a number of small antimony lodes throughout Alaska were actively developed during this time. From 1970 to 1971, Kantu Mining Company shipped 1,283 metric tons of ore of various grades to Hibino Metals of Japan and the National Lead Company of Laredo, Texas. A portion of this ore may have come from nearby lodes. The property is currently inactive, although lessees conducted surface exploration during 1981.



Base from U.S. Geological Survey Fairbanks D-2 (1954, revised 1975) and Livengood A-2 (1954) Quadrangles.

Scale 1 in. = 1 mi

Figure 1. Location map of the Scrafford property, Fairbanks mining district, Alaska.

Table 1. Production of stibnite ores and concentrates, Scrafford Lode, Fairbanks mining district, Alaska.

Date	Ore (metric tons)	Grade (% antimony)	Antimony (lbs)	Company
1915-18[a], 1926-27	1428	58	1,654,480	E. Quinn
1930s	50	56	56,000	E.R. Pilgrim
1970-71	62	60	74,400	
	1221	12-16	293,040	Kantu Mining Company
Total	2761		2,077,920	

From Martin (1919a, p. 21), Martin (1919b, p. 22-23); Brooks (1916a, p. 29-30); Brooks (1916b, p. 28-29); Hill (1933, p. 156-57); Chapin (1919, p. 321-29); Joesting (1942, p. 3-4); Joesting (1943, p. 1-5); Mertie and Killeen (1943, p. 1-4); Mertie, (1918, p. 403-425).

[a]Production estimates from Scrafford deposit during World War I are difficult to ascertain. During 1915-18, the Fairbanks mining district accounted for about 2,380 tons of ore averaging 58 percent antimony. According to Mertie and Killeen (1943) and Ebbley and Wright (1948), the Scrafford lode accounted for 60 percent of production prior to World War II. Hill's (1933) estimate of 1926 production is not included here.

REGIONAL GEOLOGIC SETTING

Rocks in the Murphy Dome area are part of the regional polymetamorphic terrane known as the Yukon-Tanana complex (Foster and others, 1973) or Yukon crystalline terrane (Templeman-Kluit, 1976). The Yukon-Tanana complex contains a wide variety of rock types, including schists, gneisses, quartzites, carbonates, amphibolites, and eclogites, all of presumed late Precambrian or early Paleozoic age.

In the Fairbanks mining district, the Yukon-Tanana complex has been subdivided---on the basis of rock-type and metamorphic grade---into three distinct, mappable units that are apparently in thrust contact (Smith and others, 1981). The three units are the Goldstream sequence, the Fairbanks schist, and the Chatanika terrane (fig. 2). The Goldstream sequence is composed of amphibolites, impure marbles, coarse-grained garnet-mica schist, quartzite, calc-silicate horizons, and black argillite, all of amphibolite-facies metamorphic grade. Structurally below the Goldstream sequence is the the Fairbanks schist, which is a sequence of greenschist-facies rocks that includes quartz-mica schist, micaceous quartzite, calc-amphibolites, actinolitic greenschist, and greenstone. Interbedded with the Fairbanks schist is the Cleary sequence, a relatively thin, lensing sequence of rocks thought to be largely of volcanic and volcanoclastic origin. Rock types within this sequence include metatuffs, greenstones, marbles, mica schist, graphitic schist, and quartzite. Most vein mineralization in the Fairbanks mining district is confined to this specific volcanic-sedimentary package. North of the Cleary sequence are rocks of the Chatanika terrane, which includes eclogites(?), garnet pyroxenites, impure marbles, and black quartzite, all of eclogite(?)- and amphibolite-facies metamorphic grade.

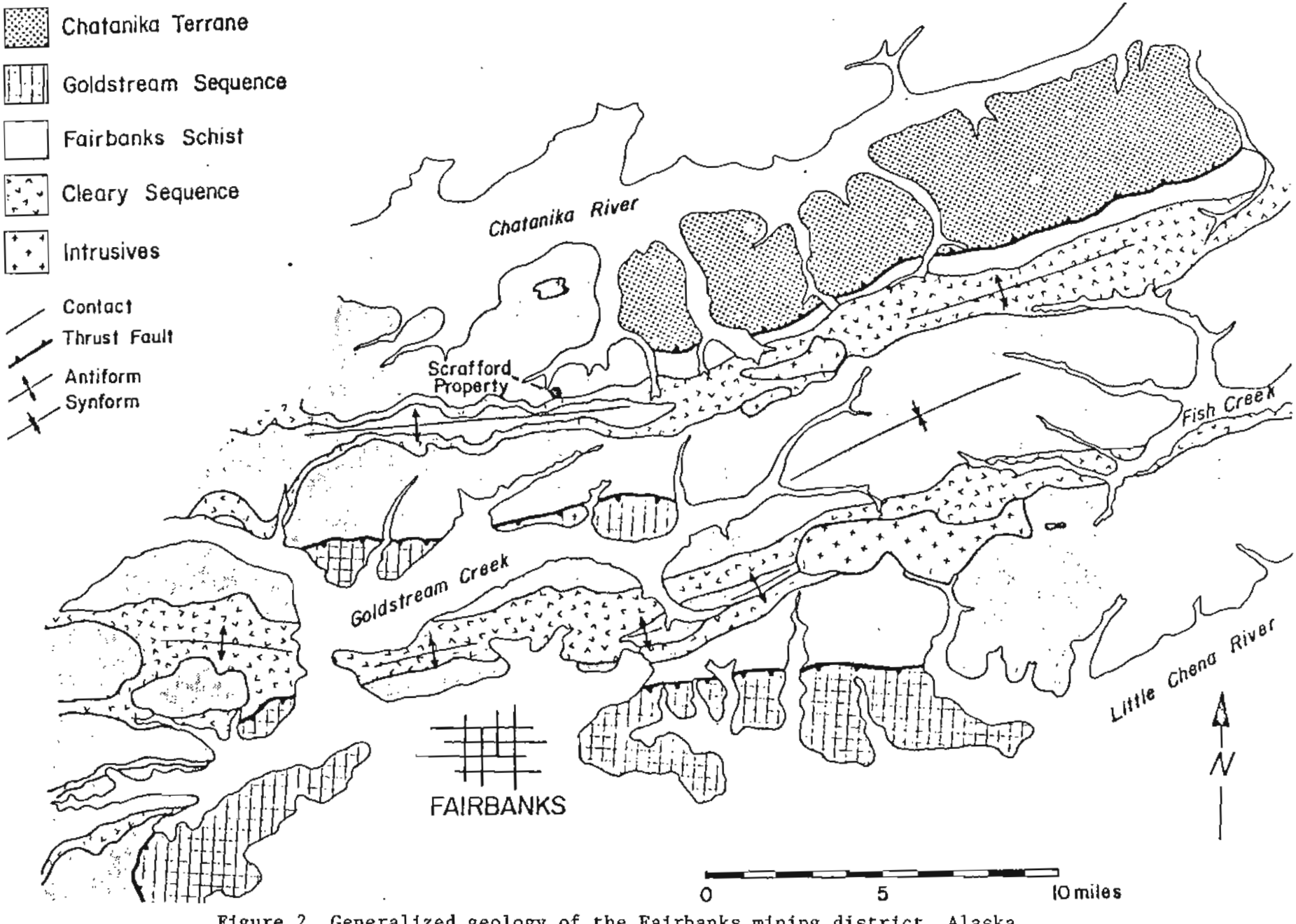


Figure 2. Generalized geology of the Fairbanks mining district, Alaska.

Locally, intrusive rocks of felsic to intermediate composition intrude rocks of the Fairbanks schist unit. According to Blum (1982), the intrusives are about 91 m.y. old, contain a high initial $^{87}Sr/^{86}Sr$ ratio (0.712), and are S-type granitic rocks formed by anatectic melting of Precambrian crustal rocks.

BEDROCK GEOLOGY OF THE SCRAFFORD OPENCUT

The Scrafford property is hosted in a mapped exposure of the Cleary sequence. Rocks in the prospect trench include quartz-mica schist, micaceous quartz schist, calc-schist, feldspathic schist, felsic tuff, and graphitic schist. Several felsic dikes are also present. The distribution of rocks in the main opencut is shown on plate 1. Caved workings to the west of the this opencut were not mapped because of poor geologic exposure. Trenches exposed to the east on the Scrafford property are also not shown.

The center of antimony-gold mineralization occurs along an east-west-trending shear zone that separates a barren hanging-wall sequence composed of quartz-muscovite schist, micaceous quartzite, and quartz-feldspar schist from a mineralized footwall sequence of feldspathic micaceous quartzite and minor quartz-mica schist. The feldspathic micaceous quartzite is considered to be a metamorphosed felsic tuff that is characteristic of the district's Cleary sequence lithologies. Footwall rocks are highly oxidized, sheared, and cut by anastomosing quartz-sulfide veinlets.

MINERALOGY AND STRUCTURAL CONTROLS

Mineralization at the Scrafford property consists of massive stibnite localized along strong shear zones and stockwork-style quartz veinlets containing disseminated arsenopyrite and stibnite in the footwall. Massive stibnite occurs in fibrous and columnar twinned crystals and as very fine-grained massive varieties. Quartz gangue is usually present in the crystalline variety. Brooks (1916a) reported the presence of minor fine gold and galena in the lode. Heavily oxidized zones contain the secondary oxides stibiconite and scorodite.

Most of the mineralized shear zone was mined by opencut methods. Only a small pillar of massive ore remains in the opencut. According to Brooks (1916a, p. 29), "The richest ore occurs in shoots which appear to be pod or lens shaped and whose long axis have a trend that diverges 15-20° from the trend of the vein." Past descriptions show that podiform ore shoots range from 30 to 80 ft long and vary from 2.5 to 3.5 ft thick. Stope orientations suggest vertical extents of at least 50 ft. A remaining pillar (pl. 1) consists of three massive stibnite ± quartz layers up to 2 ft thick separated by several feet of broken schist and mylonite. Total ore width is at least 9 ft.

The shear-zone system in the main opencut is exposed for at least 320 ft, strikes N. 80°-85° E., and dips 55°-60° S. The vein system in the shear pinches and swells from a width of 4 to 19 ft and is confined to the footwall side of the shear zone. The shear zone (including the vein) ranges from 6 to 38 ft wide. The hanging wall of the exposed shear system is dominated by

incompetent quartz-mica schist, and the footwall is locally mineralized feldspathic quartzite (metatuff). The hanging-wall schist may have acted as a barrier to ascending hydrothermal fluids, blocking their upward migration. The competent footwall quartzite is highly fractured, resulting in a favorable site for ore deposition.

According to Hall (1983, in preparation) mineralized shear zones throughout the Fairbanks mining district are spoon-shaped tensional features associated with crustal folding or doming. This model (fig. 3) is consistent with structural elements observed at the Scrafford property. Hence, competence of the country rock is the dominant control of shear zone morphology. Zones of high porosity and permeability exist where competent quartzite layers are cut by fractures. Zones of low porosity and permeability are dominated by incompetent schistose wallrock. Movement of hydrothermal fluids through the shear zone would result in deposition of ore and gangue minerals in dilatant zones within the shears. Where spoon faults intersect, the occurrence of stacked mineralized zones is possible. The doming or folding is locally associated with nearby granitic plutons that may be a source of hydrothermal fluids, or alternatively, a thermal driving source for ground-water convection cells.

Preliminary geochemical analyses of chip-channel samples from sites in the Scrafford opencut are shown on plate 1. Significant gold and antimony values in the footwall deserve further evaluation. The host footwall quartzite is a homogenous medium- to light-brown, laminated feldspathic quartzite of possible volcanic-exhalative origin. It is not known at this time if the gold values in the footwall are concentrated in the stockwork quartz veinlets or if the metals are disseminated throughout the footwall host rock; this question could be resolved by high-density chemical sampling of the footwall.

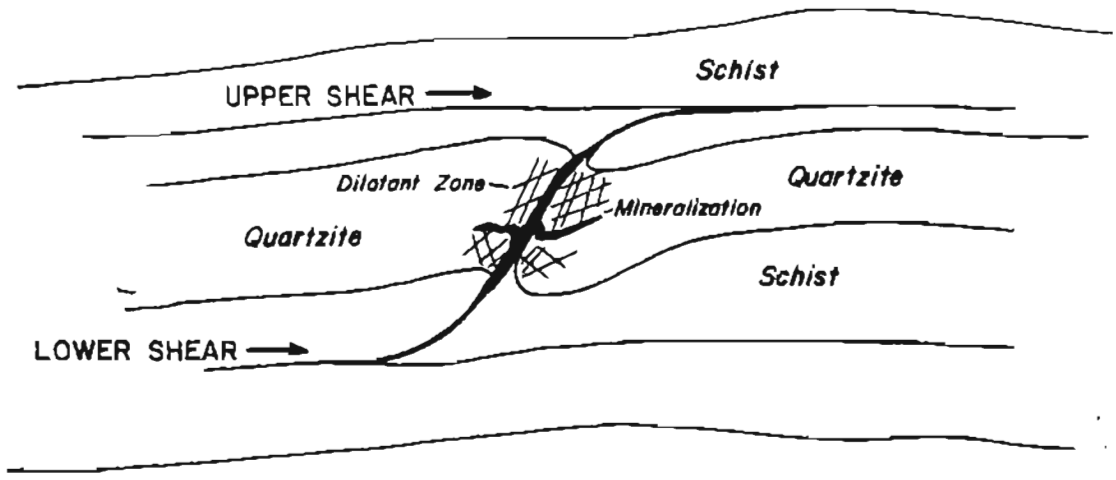


Figure 3. Model of shear-zone development, Fairbanks mining district, Alaska (from Hall, in preparation).

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