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Possible Extension of Mineral Belts Northern Part of Coeur d'Alene District, Idaho

By

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POSSIBLE EXTENSION OF MINERAL BELTS NORTHERN PART OF COEUR D'ALENE DISTRICT, IDAHO

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ABSTRACT

The ore deposits in the northern part of the Coeur d'Alene district are located within rocks of the Belt Supergroup that have been intruded by Cretaceous quartz monzonites. Lead-zinc-silver replacement veins constitute most of the deposits. The geometry of the district has been modified by post-ore faulting along the Osburn, Dobson Pass, and other faults. The original position of the Gem stocks, before their separation from the Dago Peak stocks by the Dobson Pass fault, can be approximately reconstructed by moving the truncated stocks and associated geochemical dispersion patterns back into matching positions. The known mineral belts are defined by dispersion patterns of both lead and the lead:zinc ratio. Similar dispersion patterns of lead and the lead:zinc ratio northwest of the original position of the Gem stocks suggest that the mineral belts extend into that area.

INTRODUCTION

The ore deposits in the Coeur d'Alene district of northern Idaho (fig. 1) are largely lead-zinc-silver replacement veins in highly folded Precambrian Belt Supergroup quartzites, siltites, and argillites. Within the Coeur d'Alene district the exposed Belt Supergroup rocks range in thickness from 7,600 to 9,500 m (25,000-31,000 ft) where the top has been eroded and the bottom is not exposed. These rocks have been intruded by Cretaceous quartz monzonites (fig. 2). Galena, sphalerite, and tetrahedrite are the most important ore minerals, and chalcopyrite is probably present in most, if not all, ore deposits. Siderite is an abundant gangue mineral, and pyrite is ubiquitous.

The geometry of the Coeur d'Alene district has been modified by post-ore faulting along the Osburn, Dobson Pass, and other faults (Hobbs and others, 1965). Movement along the normal, westward-dipping Dobson Pass fault has offset the roots of the monzonite intrusions, known as the Gem stocks, from their cupola, which is represented by the Dago Peak stocks and parts of

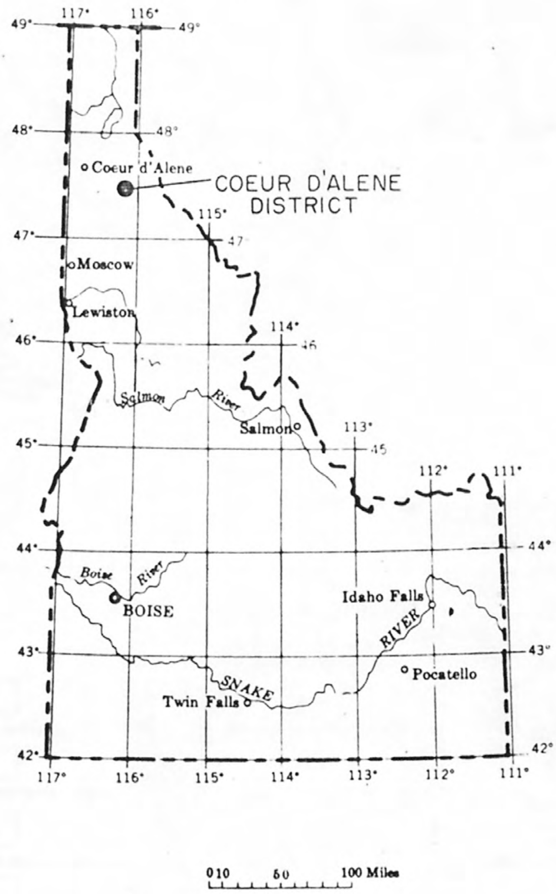

Figure 1.--Index map of Idaho showing location of Coeur d'Alene district.

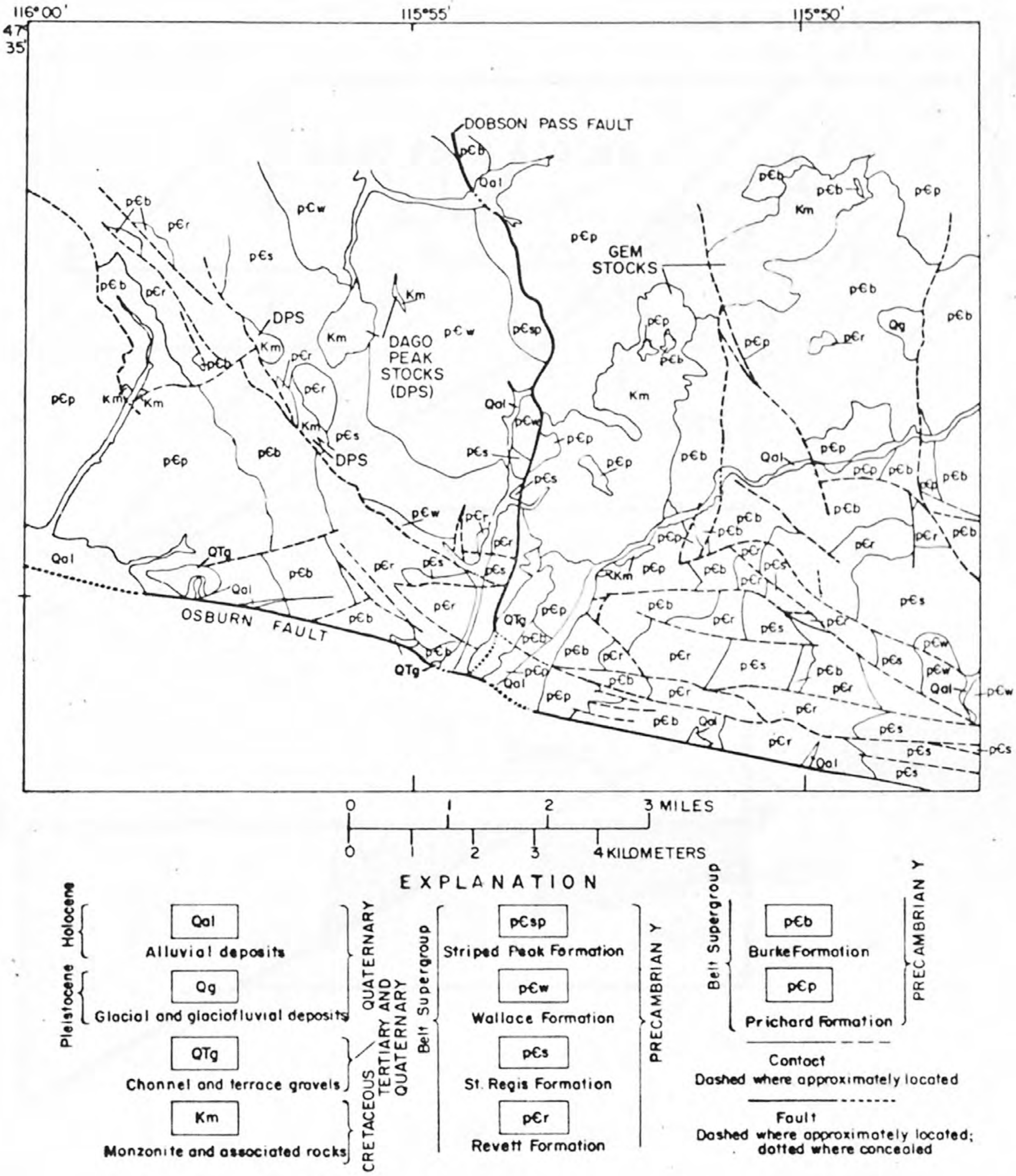

Figure 2.--Generalized geologic map of the Coeur d'Alene district. Modified from Hobbs and others (1965, pls. 305).

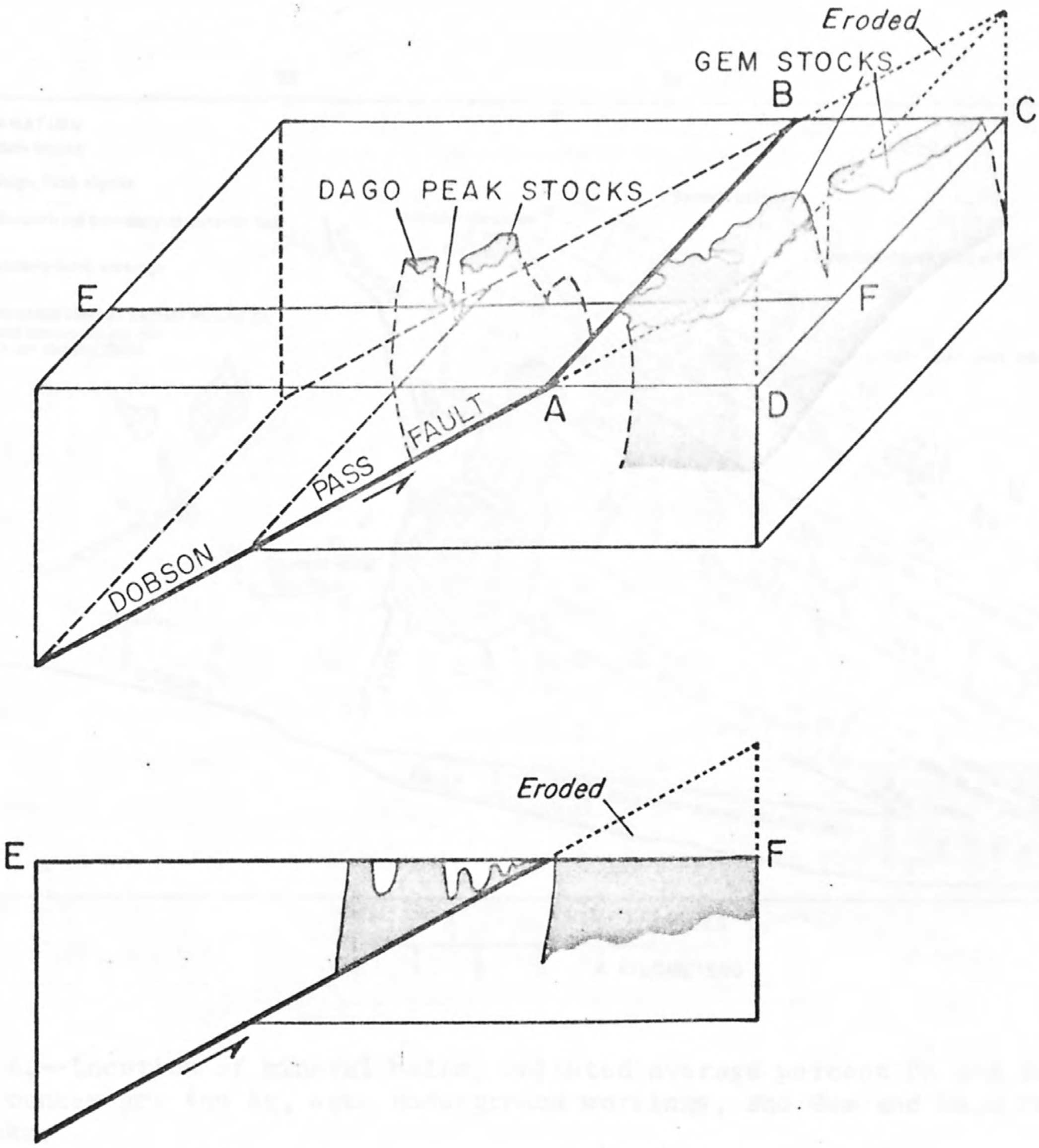

Figure 3.--Diagram showing offset of Gem stocks from Dago Peak stocks.

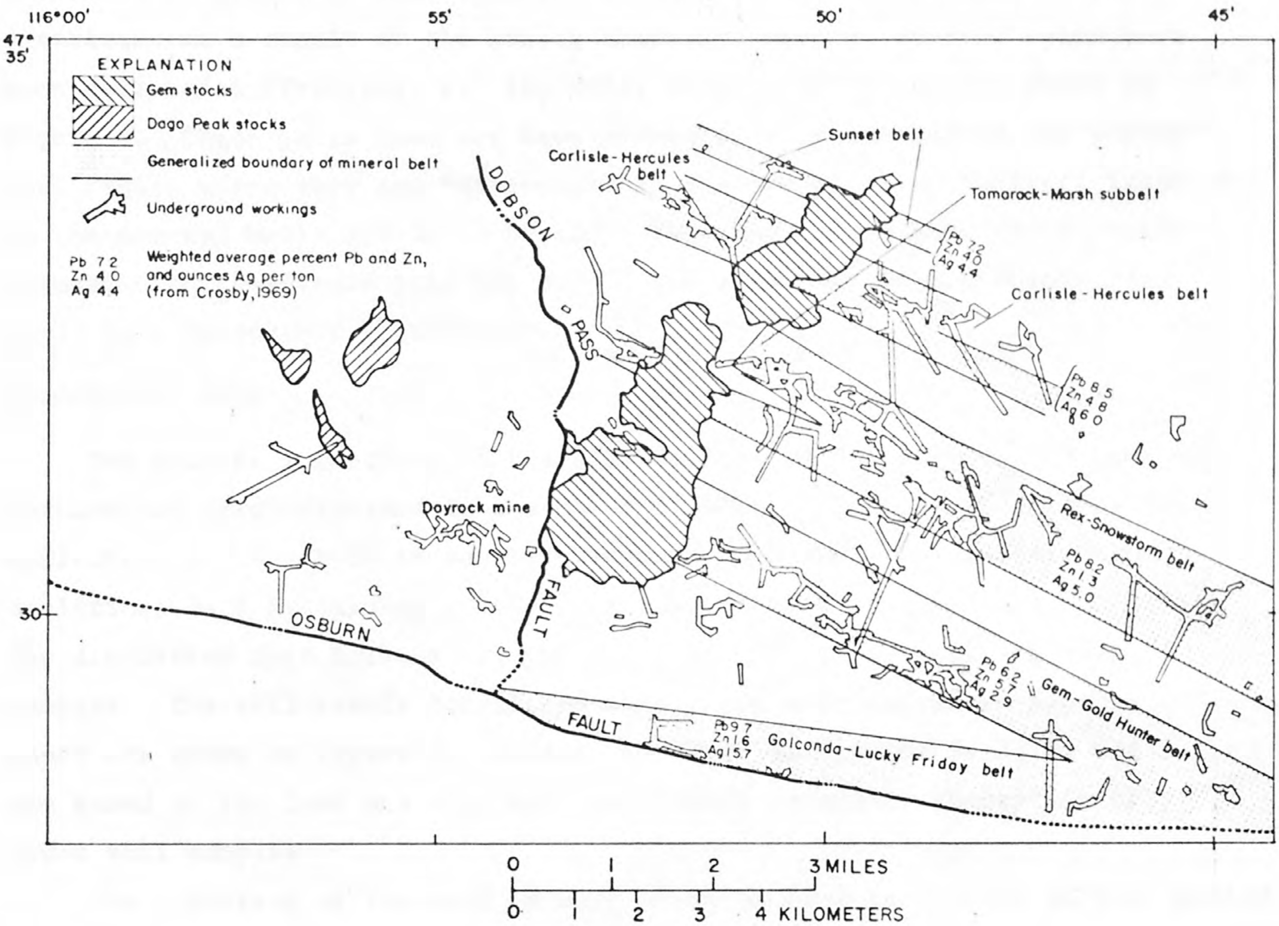

Figure 4.--Location of mineral belts, weighted average percent Pb and Zn, and ounces per ton Ag, some underground workings, and Gem and Dago Peak stocks.

numerous lead-zinc-silver veins (fig. 3). The eastward fault block has been the locus of mining of lead-zinc-silver ores since mining began in the district. As a result of the mining activity, several mineral belts have been delineated (Fryklund, pl. 2A, 1964; Crosby, 1973) and are shown on figure 4. These belts have not been proved to continue beyond the Dobson Pass fault, where they are interrupted by the Gem stocks. However, inasmuch as the mineral belts appear to be older than the Dobson Pass fault, their extension northwestward into the synclinal area west of the Dobson Pass fault is a reasonable possibility.

GEOCHEMICAL DATA

The writers and others of the U.S. Geological Survey recently have made geochemical investigations in the Coeur d'Alene district that involve the collection and analysis of several thousand rock and soil samples. The analytical data pertaining to the rock samples have not yet been evaluated; the discussion that follows is, therefore, based on the analyses of soil samples. The soil-sample localities within the area discussed in this paper are shown on figure 5. Localities shown in figures 6, 7, 8, and 9 are based on the lead and zinc data determined by atomic absorption of these soil samples.

The A horizon of the soil is only 25-50 mm (1-2 in.) thick in most places within the Coeur d'Alene district. This horizon was not sampled because of the possibility of contamination resulting from mining activity. Orientation studies of several dozen soil profiles indicate that except in the Kellog locality, soil samples collected in the Coeur d'Alene district from depths greater than about 15 cm (6 in.) below the A horizon are free from contamination. All samples from the area discussed in this report, therefore, were collected at or below this depth.

A computer-implemented graphics technique has been used to illustrate the geochemical relationships. The original analytical data were expanded to include ratios of the more common sulfide-forming elements. All data were then gridded to a rectangular coordinate system with mesh points 305 m (1,000 ft) apart.

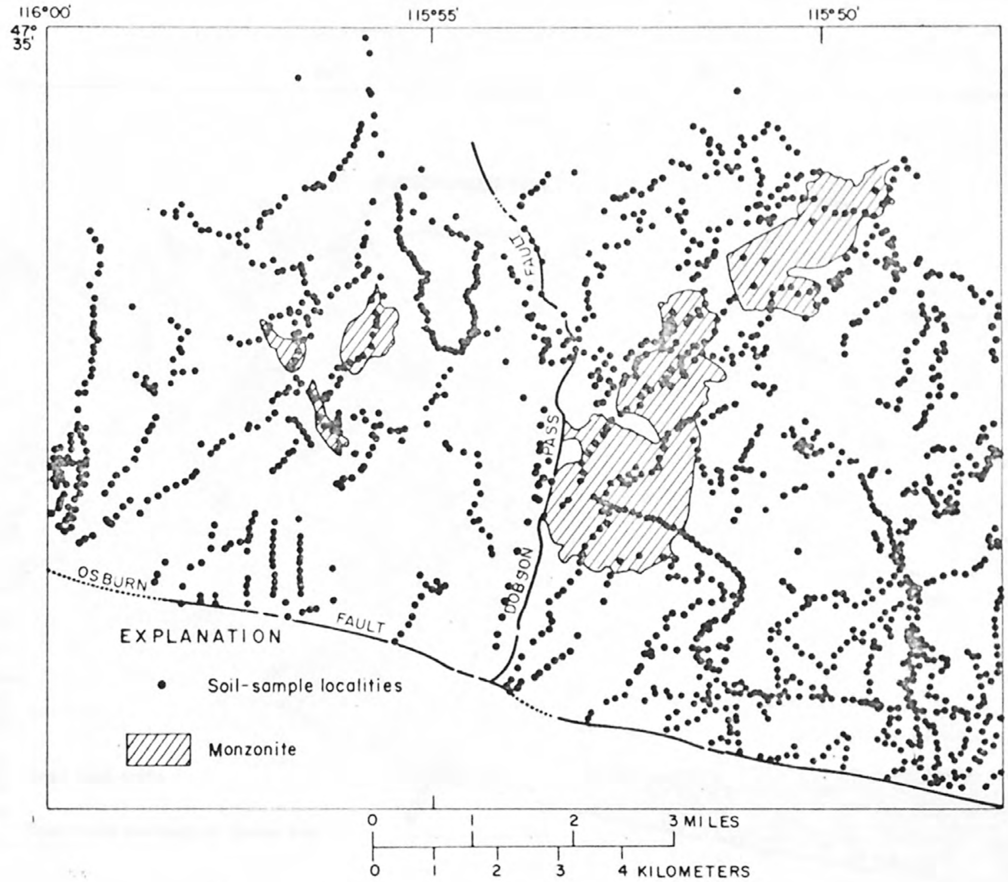

Figure 5.--Soil sample localities.

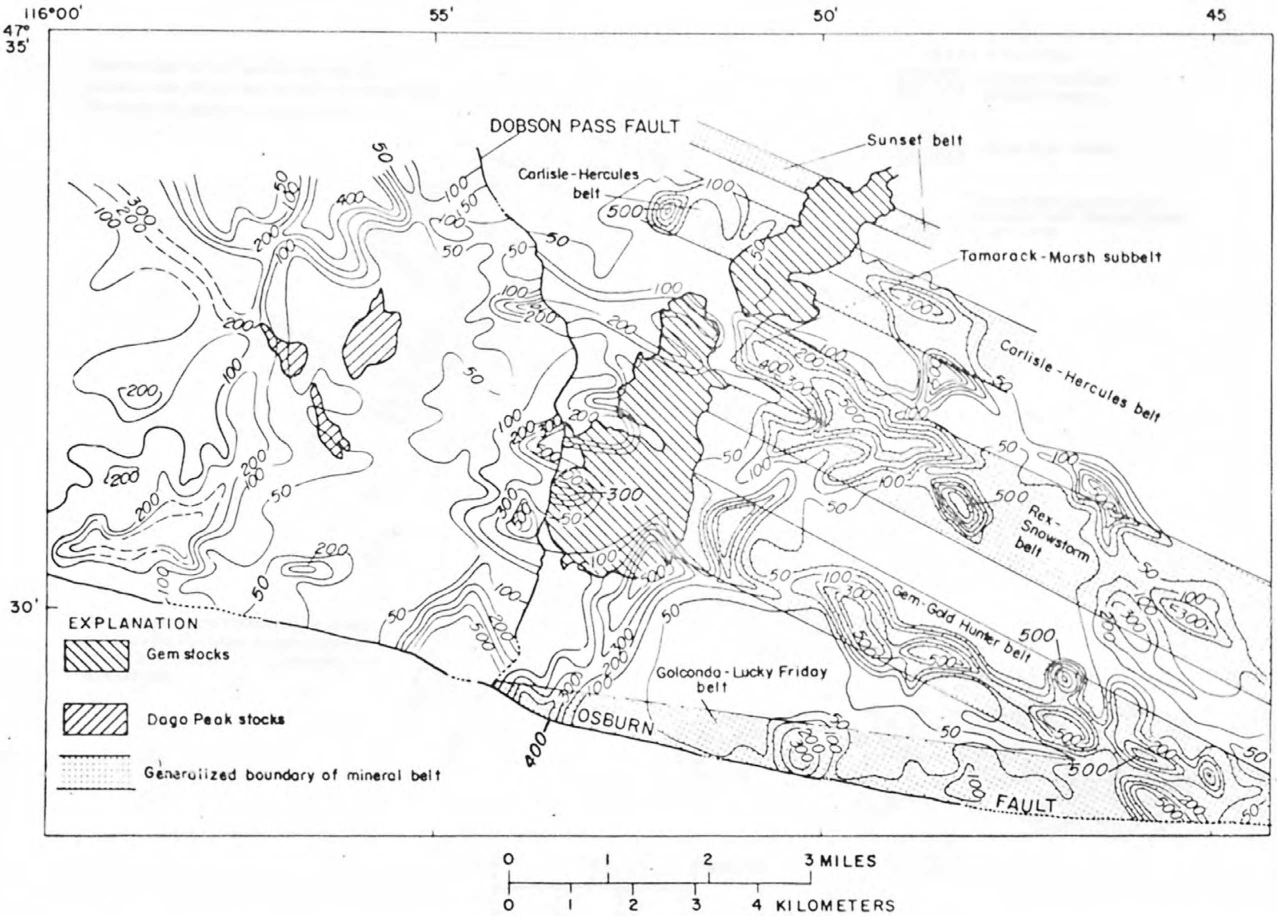

Figure 6.--Present distribution of lead. Contours are at 50, 100, 200, 300, 400, and 500 ppm Pb; dashed where projected.

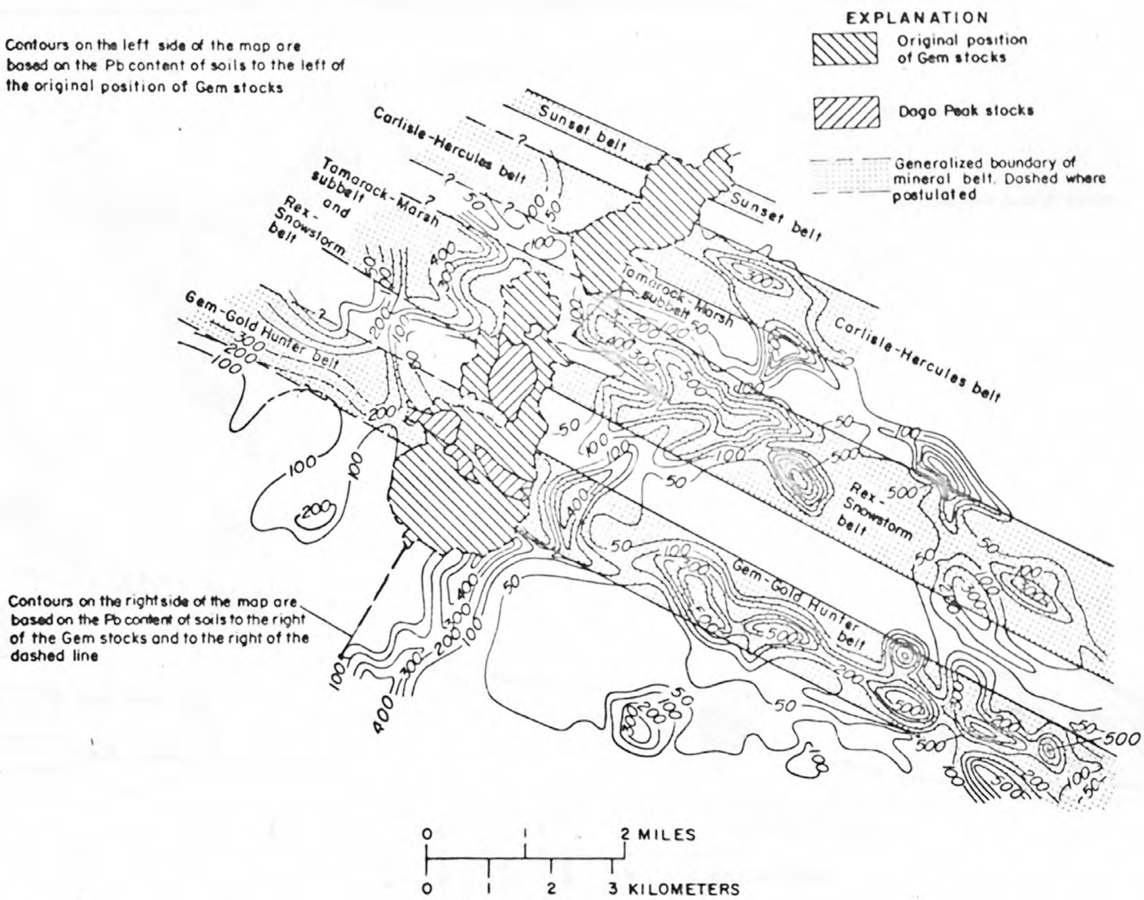

Figure 7.--Dispersion pattern of lead restored to its pre-Dobson Pass fault position. Contours are at 50, 100, 200, 300, 400, and 500 ppm Pb; dashed where projected.

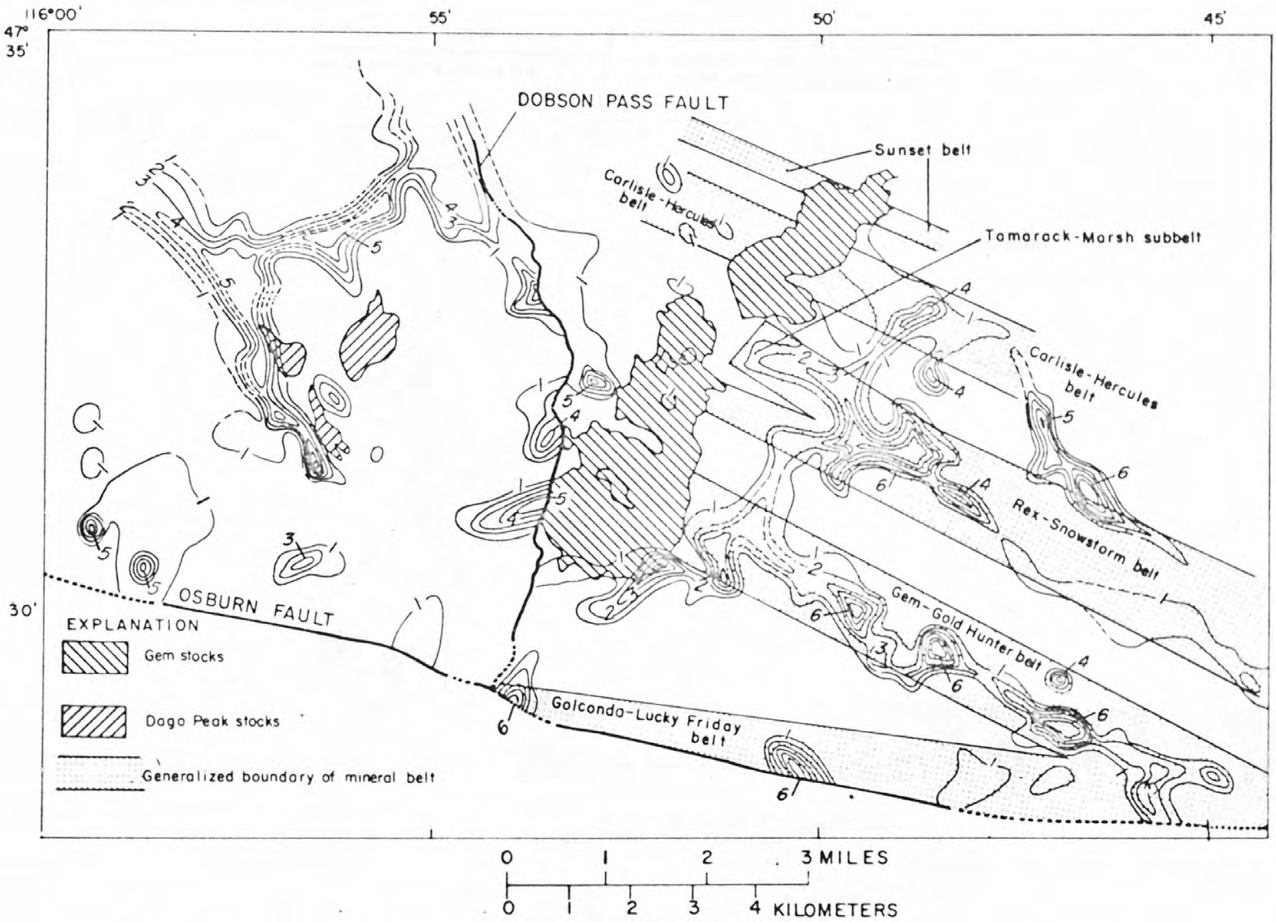

Figure 8.--Lead:zinc dispersion pattern. Contour interval is 1; not contoured above 6; dashed where projected.

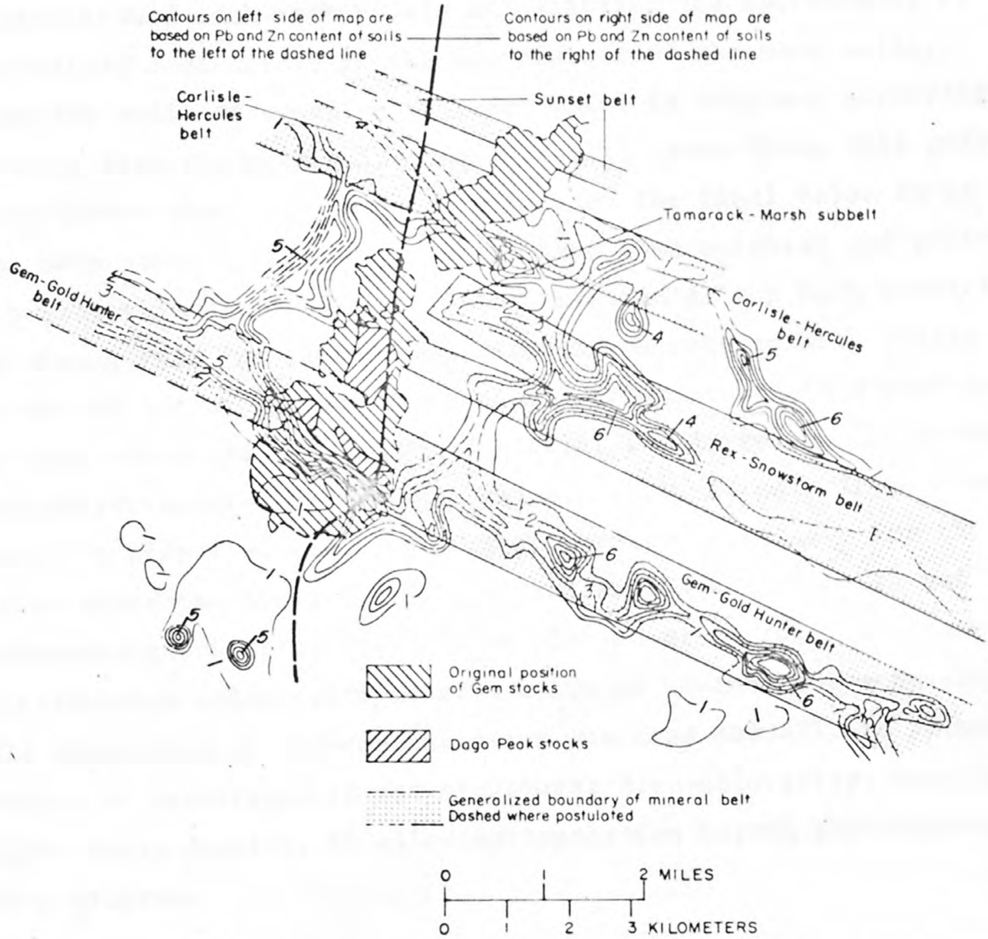

Figure 9.--Lead:zinc dispersion pattern restored to its pre-Dobson Pass fault position. Contour interval is 1; not contoured above 6; dashed where projected.

Using the computer graphics technique, the original data points are transposed to grid coordinates or mesh points by drawing a circle of arbitrary size around each mesh point, and shifting the coordinates of data points within each circle to the coordinates of the mesh point. Accompanying the shift of coordinates, each point is weighted according to its distance from the mesh point; as a result, close-lying data points have more influence than outlying data points on the final value to be used at the mesh point. After data points have been weighted and projected to a mesh point, the multiplicity of values created at the mesh point is removed by averaging. The extent of interpolation between mesh points is determined by the radius of the search circle drawn around each mesh point. The larger the radius and circumscribed circle, the larger is the number of data points represented by a single value. Thus, larger circle sizes have a smoothing effect on the resulting geochemical surface. For the illustrations presented here, a circle of radius 305 m (1,000 ft) was used.

The computed geochemical values were plotted at coordinate intersections on an X-Y flat-bed plotter equipped with a 50- by 60-inch (127- by 152-cm) table. All contouring of iso-concentration was done manually to permit interpretation of stratigraphic and structural discontinuities, and, in areas of low sample density, to allow extrapolation beyond the bounds set in the gridding program.

KNOWN MINERAL BELTS

The generalized boundaries of the known mineral belts as shown on figure 4 have been taken from Fryklund (pl. 2A, 1964). Those mineral belts pertinent to this paper are the Gem-Gold Hunter belt, the Rex-Snowstorm belt, the Tamarack-Marsh subbelt, the Carlisle-Hercules belt, and the Sunset belt. The belts are nearly parallel to each other and trend about N. 65° W. They range in width from about 500 to 1,600 m (1,640-5,250 ft). Their boundaries are obscure and are generally determined by the outermost mineralized structures. The mineral belts cross fold structures, lithology, and the various Belt Supergroup formations. The ore shoots that constitute the ore bodies are fracture controlled and, in general, trend parallel or subparallel to the mineral belts.

These mineral belts have been the center of mining activity since ore was first discovered in the district in 1885. Crosby (1969) gives the tonnage of lead-zinc-silver ore mined through 1967, from all of the mineral belts north of the Osburn fault, as 54,301,376 tons with a weighted average of 7.2 percent lead, 4.0 percent zinc, and 4.4 ounces silver per ton. The extent of this mining activity can be seen from some of the underground workings (generalized from the mapping of Hobbs and others, pls. 3-5, 1965) that are plotted on figure 4.

The mineral belts are characterized by a dominance of lead over zinc. The data given by Crosby (fig. 4) show that within the various mineral belts the lead:zinc ratio of the ores ranges from about 1:1 to 6:1. The soil samples collected over these mineral belts have a similar lead:zinc ratio which ranges from 1:1 to greater than 6:1. In contrast, the median values for lead and zinc of all soil samples collected from the Coeur d'Alene district as a whole are 43 and 95 ppm respectively.

The known mineral belts in this area are in part defined by the geochemical distribution of lead, silver, zinc, copper, and antimony, but are best defined from the data resulting from the analysis of soil samples according to the distribution of lead and the lead:zinc ratio. Lead and the lead:zinc ratio (figs. 6 and 7) well define the Gem-Gold and Hunter belt and Tamarack-Marsh subbelt and partly define the Rex-Snowstorm and Carlisle-Hercules belts. Insufficient samples were collected to determine whether or not the Sunset belt could be defined.

INTERPRETIVE EXTENSIONS OF THE MINERAL BELTS

The rocks in the area east of the Dobson Pass fault have been more dissected than have the rocks on the western side. On the eastern side of the fault, favorable host rocks in the Prichard, Burke, Revett, and St. Regis Formations have been exposed. In contrast, on the western side of the fault, parts of the Striped Peak and Wallace Formations, and the upper part of the St. Regis Formation overlie the older rocks. Termination of the mineral belts against the post-ore Dobson Pass fault gives reason for speculation that these belts continue in the favorable host rocks at depth beneath the Wallace and upper part of the St. Regis Formation west of the fault. This speculation encouraged an attempt to approximate the original geologic structure by removal of the Dobson Pass fault on the premise that this restoration of the original structure would reveal evidence indicative of whether the mineral belts do extend beyond the fault.

This restoration was made on the assumption that the Gem stocks were truncated from the Dago Peak stocks and faulted eastward along the Dobson Pass fault. The Dobson Pass fault dips about 27° westward, and a projection of this fault indicates that it truncated the Gem-Dago Peak stocks at depths ranging from 1,500 to 2,400 m (4,920-7,870 ft) (fig. 3). As a result of this faulting, the Gem stocks were offset about 5 km (3.1 mi) eastward. Erosion has subsequently cut deeply enough into the upthrown block to expose many ore deposits in the known mineral belts, but with the exception of the Dayrock Mine, no known commercial deposits have been exposed in the downthrown block.

Restoration of geologic structure prior to Dobson Pass faulting was accomplished by sliding the part of the map that is east of the fault under the western part of the map until the Gem stocks fit under the Dago Peak stocks. The best fit obtained by this procedure required a western translation of about 5 km (3.1 mi) and a 21° clockwise rotation of the Gem stocks from their present position (fig. 6). The outlines of the south stock and that part of the north stock occurring west of the Dobson Pass fault were then traced on the map in their approximate original positions.

This restoration brings the lead and the lead:zinc-ratio dispersion patterns that currently define all or parts of the known mineral belts into juxtaposition with similar lead-dominant dispersion patterns which occur on opposing sides of the restored Gem stocks (figs. 7 and 9). Strong dispersion patterns of lead west of the original position of the Gem stocks, shown on figure 7, match the Gem-Gold Hunter belt and the combined Rex-Snowstorm-Tamarack-Marsh belts. A somewhat weaker dispersion pattern corresponds to the Carlisle-Hercules belt.

The lead:zinc-ratio dispersion patterns west of the original position of the Gem stocks (fig. 9) correspond to extensions of the Gem-Gold Hunter and Carlisle-Hercules belts. However, because of an increase in zinc in that area, these patterns do not indicate an extension of the Rex-Snowstorm belt or Tamarack-Marsh subbelt.

In addition to these northwest-trending dispersion patterns that correspond, in part, to the known mineral belts, northeast-trending dispersion patterns of lead and lead:zinc are also present. These patterns conform to the shape and orientation of the south Gem stock. This conformity suggests that these patterns may have resulted from the migration of the metals from the northwest-trending mineral belts as a result of heat that was still emanating from the stock.

The anomalously high lead northwest of the Dago Peak stocks occurs along the strike of the Revett and Wallace Formations, and it is possible that lead-rich strata occur in these formations that would account for the distribution patterns shown in figures 7 and 9. Numerous deposits of the stratiform type have been observed within the Belt Supergroup in recent years. For example, Clark (1971) described strata-bound copper deposits in the Revett Formation, which are overlain by a lead-rich zone in the Idaho-Montana area north of the Coeur d'Alene district. The presence of such strata-bound lead in the lead-rich zones northwest of the Dago Peak stocks would negate the postulation that these zones represent the extensions of vein deposits included within the mineral belts present southeast of the Gem stocks. The distribution patterns of lead in the soils throughout the Coeur d'Alene district, however, suggest that concentrations in the range of 400-500 ppm or more have been derived from deposits that are structurally controlled. By analogy, therefore, it seems likely that the dispersion patterns of lead and lead:zinc in the area northwest of the Dago Peak stocks have been derived from vein deposits similar to those in the known mineral belts rather than from stratiform deposits.

This interpretation permits the conclusion that the dispersion patterns northwest of the Dago Peak stocks (figs. 7 and 9) represent extensions of the mineral belts. The dominance of lead over zinc, which characterizes the dispersion patterns northwest of the Dago Peak stocks as well as patterns in the known mineral belts, suggests that the dispersion patterns beyond the original position of the Gem stocks define extensions of the mineral belts.

A simple dichotomy at the Dobson Pass fault influences the interpretation of the position of mineral belts west of the fault trace: The mineral belts in the hanging wall block have been truncated by the fault, whereas the mineral belts in the footwall block are structurally continuous across the trace of the fault and have been rotated about 20° in a counter-clockwise direction. There would, therefore, be a divergence in the alinement of the belts in the two blocks depending on the precise amount of rotation in the footwall block. For this reason the projected extensions of the mineral belts shown on figures 7 and 9 would apply only to the hanging wall block.

ACKNOWLEDGMENTS

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