

## *Magmatic Source of Idaho Ores—A Discussion*<sup>1</sup>

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IN A RECENT PAPER, "Magmatic Source of Idaho Ores," A. L. Anderson (1952) made certain assumptions that might appear to the reader not personally acquainted with the geology of the region to be well-established facts or at least nearly certain interpretations. Various ramifications of some of these interpretations and evidence that indicates less certainty and possibly contradictory interpretation are presented here. Evidence and ideas presented by the authors have been gained during a program of detailed mapping and study of the Coeur d'Alene mining district by the U. S. Geological Survey that was begun in 1947 and is still continuing.

Few, if any, men have personal acquaintance with as many regions of Idaho as A. L. Anderson, and the concepts he has developed by the integration of his fund of personal observations are of considerable interest to the geologic fraternity.

Specific quotations from Anderson's paper and corresponding discussions follow:

*" . . . the localization of the Coeur d'Alene intrusions along a zone of structural weakness dominated by the Osburn fault which, like the zones of structural weakness that cut the Idaho batholith, came into existence during the Laramide disturbance . . . "*

The monzonitic stocks of the Coeur d'Alene district lie along a line trending northeast almost at right angles to the trend of the Osburn fault and parallel structures. Some of the individual stocks, furthermore, also are elongated in this direction (Ransome and Calkins, 1908, pl. 2). It is difficult to understand how Anderson considers them controlled by "*a zone of structural weakness dominated by the Osburn fault.*"

The Herrick stock (Wagner, 1949) to the southwest and other monzonitic plutons in the Trout Creek (Gibson *et al.*, 1941) and Libby quadrangles (Gibson, 1948) to the north lie very nearly along the same northeast-trending line.

Assignment of the Osburn fault to the "Laramide disturbance" has been customary, but it should be kept in mind that there is little direct evidence of

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this, and in lieu of such direct evidence the assignment generally has been made principally by assuming a regional distribution of the disturbance; yet throughout the Tertiary as well as earlier in the northern Rocky Mountains province there has been tectonic unrest at numerous times.

*"The close association of the ore deposits with igneous rocks in the Coeur d'Alene district is a matter of record . . ."*

Admittedly most geologists who have studied the Coeur d'Alene district have assumed that the monzonitic stocks are in some way related to the ores. Spatially, however, the relationship of ore bodies to monzonite is far from close. Lead-zinc veins are distributed at rather close intervals in an 80-mile-long belt along the Osburn fault system; yet, as pointed out previously, the monzonitic stocks follow a trend nearly at right angles to the Osburn fault system.

In detail also there is little spatial relationship of ore to monzonite. Recent study by the U. S. Geological Survey has emphasized the belt-like character of the distribution of major ore bodies in the Burke-Mullan area. The veins typically strike about N. 60°-70° W. and are grouped in belts that also have this trend, approximately parallel to the Osburn fault. The trend of the veins and belts is similar both west and east of the monzonite, as though controlled by a structural lineament distinct from that which controlled the monzonitic intrusions.

The Bunker Hill and Sullivan mine and the Silver Belt group of ore bodies form a 10-mile-long belt south of and approximately parallel to the Osburn fault apparently with little distributional or spatial relationship to the stocks. Aeromagnetic surveys by the U. S. Geological Survey in 1947 indicate slightly more widespread distribution of the monzonite below the surface, but no major difference from the pattern of distribution shown by surface exposures.

As to the time of major ore deposition, it is agreed the evidence seems strong that most was post-monzonite; nevertheless, there is also evidence suggesting that some might have been deposited earlier and that, at least, the history likely has been complex rather than simple. Recent work on uraninite from the Sunshine mine (Kerr and Kulp, 1952) shows evidence for pre-Cambrian age of at least part of the mineralization in the Coeur d'Alene mining district, even though its present position structurally might be a result of reworking by later ore solutions. Many ore bodies are intensely sheared; many are offset by faults, and the fibrous appearance of galena so common in the district is a result of adjustment to shearing stresses. Such evidence clearly shows that there has been post-ore deformation and that the structural history probably cannot be lumped into one simple disturbance.

The fact remains that the correlation of ore to monzonite as a "child-to-parent" relationship arises from the habit of thought of relating the nearest intrusive to the ore bodies. A much less direct relationship may more nearly represent the truth.

*" . . . the potash-rich emanations were directed upward along deeply extending fault zones in relatively cold rocks and because of the lower temperatures the rocks were sericitized rather than feldspathized."*

Although abundant sericite is present in the "bleached" rocks of the Coeur d'Alene mining district, some doubt has been expressed by Mitcham (1952) and Hobbs *et al.* (1950) as to the amount of introduced potash. In most of the argillites and impure quartzites of the Belt series there is abundant sericite in "unbleached" rocks, and the distinction between sericite produced by introduction of hydrothermal potash and either sedimentary sericite or sericite produced by reconstitution of sedimentary material has not yet been accomplished. Until this relationship is understood, it will be difficult to be sure of the amount, if any, of potash that has been introduced.

*"Petrologic studies reveal that the intruding magma had a moderately basic composition and consolidated as a quartz-bearing diorite or norite and that while still hot the rock was transformed into monzonite and syenite by the action of potash-rich emanations from depth."*

One of the striking distributional features of the "bleaching" in the Coeur d'Alene district is that there is no localization of bleaching around the monzonitic bodies; rather the principal "bleached" zones are far from the stocks. If, as Anderson postulates, "*emanations from depth*" transformed the earlier diorite and norite, it is difficult to understand why the solutions failed to attack country rock surrounding the stocks, yet did so at considerable distance from the stocks. It is agreed that there appears to be a late alteration with development of potash feldspars in the stock, but the lack of effect on the country rock suggests that the materials needed in the alteration were held rather intimately within the igneous mass itself and came from no great distance.

Scantiness of evidence makes it impossible to judge some of Anderson's statements; yet the same scant evidence scarcely forms a sound basis for such positive statements as Anderson makes. For example, Anderson's statement, "*The batholith was thus proved to be barren of related mineral deposits, except pegmatites,*" carries a tone of finality that is almost completely unfounded. Likewise, the statement, "*. . . found no petrographic resemblance between the monzonitic and syenitic rocks of the Coeur d'Alene district and the quartz dioritic, granodioritic, and quartz monzonitic rocks that compose the Idaho*

*batholith*," on face value alone seems inconsistent. When it is considered that Anderson postulates that some of the monzonite was originally diorite, one wonders exactly how such a positive distinction is made between quartz diorites and diorites; for that matter, between monzonites and granodiorites.

Anderson's ideas warrant serious consideration and represent valuable working hypotheses; but it is unfortunate that such positive assertions are made, because it leads the reader to believe that many of our basic problems are essentially solved when actually our understanding of this large and complex problem is only in its infancy.

#### *Literature Cited*

- Anderson, A. L. 1952. Magmatic source of Idaho ores. *Northwest Science*, 26(2): 55-60.
- Gibson, Russell, W. F. Jenks, and Ian Campbell. 1941. Stratigraphy of the Belt series in Libby and Trout Creek quadrangles, northwestern Montana and northern Idaho. *Geol. Soc. Amer. Bul.* 52: 363-380.
- Gibson, Russell. 1948. Geology and ore deposits of the Libby quadrangle, Montana. *U. S. Geol. Surv. Bul.* 956: 1-128.
- Hobbs, S. W., R. E. Wallace, and A. B. Griggs. 1950. Geology of the southern third of the Mullan and Pottsville quadrangles, Shoshone County, Idaho. *U. S. Geol. Surv. Open-file report*: 1-12.
- Kerr, P. F. and J. L. Kulp. 1952. Pre-Cambrian uraninite, Sunshine Mine, Idaho. *Science*, 115(2978): 86-88.
- Mitcham, T. W. 1952. Significant spatial distribution patterns of minerals in the Coeur d'Alene district, Idaho. *Science*, 115(2975): 11.
- . 1952. Indicator minerals, Coeur d'Alene Silver Belt. *Econ. Geol.*, 47: 414-450.
- Ransome, F. L., and F. C. Calkins. 1908. The geology and ore deposits of the Coeur d'Alene district, Idaho. *U. S. Geol. Surv. Prof. Paper* 62: pl. 2.
- Wagner, W. R. 1949. The geology of part of the south slope of the Saint Joe Mountains, Shoshone County, Idaho. *Idaho Bur. Mines and Geology Bul.* 82: 17.

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