

Magmatic Source of Idaho Ores—A Reply

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THE WRITER APPRECIATES the interest that has been manifested in his summary report of the "Magmatic Source of Idaho Ores." Unfortunately, the brevity of the report has obviously led to some misunderstandings of the writer's ideas, particularly those dealing with the ore-magmatic relationships in the Coeur d'Alene district, a district selected chiefly because of local interest. Thus further discussion appears needed for clarification.

Although most geologists have assumed that the monzonitic stocks in the Coeur d'Alene district are in some way related to the ores, the writer has not claimed that the mineralization along the Osburn fault system is directly related to the monzonite. On the contrary he points out (Anderson, 1952*b*) that ". . . through most of the district the ore deposits show a particularly close association with diabasic and lamprophyric dikes, the ores having been introduced after the intrusion of the diabases and before the formation of the lamprophyres." It is only in the Burke-Mullan area that the monzonitic rocks enter the picture and there the zonal distribution of the ores about the Gem stock is interpreted by the writer as thermally controlled, with the monzonite locally bringing high temperature relatively close to the surface. The ore and monzonite are not regarded in a "child-to-parent" relationship, but the ore and the monzonite as well as the diabasic, lamprophyric, and other intrusives, as stated in the paper, are considered as offspring of a deep-seated magma, which differentiated at depth and gave birth to the potassic emanations, ores, and various igneous rocks, now exposed in the district. There was no intent to relate the ores of the Bunker Hill-Silver Belt area to the monzonitic intrusives of the Burke-Mullan area. Igneous activity is manifested here and there along the Osburn fault zone and is particularly well expressed near Wolf Lodge Bay on Coeur d'Alene Lake.

Except for bringing high temperatures relatively close to the surface and thus affecting the thermal characteristics of the ore deposits in their vicinity, the monzonitic rocks appear to have little direct bearing on the mineralization. They do, however, provide some data on what had taken place in the deep magma chamber. The emplacement of the monzonitic bodies appears to be

independent of and uncontrolled by the movement along the Osburn fault zone. The elongation and alignment of the monzonitic bodies at about right angles to the trend of the Osburn fault may suggest control by complementary shears, developed during earlier stages of the crustal disturbance and then utilized by the monzonitic magmas before the fracturing along the main Osburn fault zone had been very far advanced. The smaller diabasic and lamprophyric bodies are, however, deployed along the zone of the Osburn fault. As thermal relations indicate monzonitic intrusion and mineralization are not widely separated in time, the structures in control of intrusion were probably not formed much ahead of the fracturing along the main Osburn zone and both were probable products of the same crustal disturbance, with the Osburn fault formed mostly during later stages of the disturbance. The writer does not presume that the structural disturbance was a simple one; but, as he has pointed out in many of his other reports, the disturbance involved structural movements over a long period of time, before and during igneous intrusion, subsequent mineralization and after, with much movement occurring while mineralization was underway.

The question has been raised why, if ". . . emanations from depth transformed the earlier diorite and norite to monzonite and syenite, they failed to attack country rock immediately surrounding the stocks, yet did attack it at considerable distance from the stocks (indicated by bleaching)." Apparently Messrs. Wallace, Hobbs, and Griggs failed to comprehend the significance of the statement made in the report that the "*introduced potash caused widespread replacement of the earlier rock by potash feldspar and where the emanations permeated into the bordering sedimentary rock also replaced that rock by feldspar and changed it to syenite.*" This matter is discussed in an earlier paper to which reference was made (Anderson, 1949) and photomicrographs of the "syenitized" quartzitic rock were there offered in evidence. Because of the higher temperature induced by igneous intrusion, the bordering rocks were apparently replaced by potash feldspar rather than the lower temperature sericite, with the potash consumed before the emanations could reach outer rocks sufficiently cool to permit formation of sericite or before they cooled to the sericitic stage. In the more distant bleached zones the potassic emanations utilized altogether different channels and permeated rock not preheated by igneous intrusion. It may be pertinent to add that the writer has since found that emanations from a body of hornblende-biorite diorite in the Yellowjacket district in Lemhi County, Idaho, have also induced the formation of an envelope of syenitic rock. This rock is megascopically and microscopically indistinguishable from much of the syenite in the Coeur

d'Alene district (Anderson, 1952*a*). Apparently, in the Yellowjacket district, the alkali-rich emanations permeated the bordering quartzitic rock rather than the diorite body itself and caused widespread replacement of the border rock by potassic and sodic feldspars. There appears to be no "bleaching" or sericitization of the sedimentary rock bordering the syenite.

How much of the sericite in the "bleached" rocks in the Coeur d'Alene district has come from introduced potash and how much may have come from reconstitution of sedimentary materials has not yet been determined. It does not seem likely that much of the sericite in some of the sericitized quartzitic rock came from materials originally present in the siliceous sediment itself, for in some of the alteration zones studied the amount of sericite present is beyond that which could normally develop by reconstitution of original materials. Addition of potash from outside sources seems the logical answer. If the bleaching has been accomplished by hydrothermal solutions, then magmatic source for the solutions and the potash seems likely.

Most readers must realize that little more than a summary of conclusions can be made in a short article covering such a broad subject and that the amount of evidence that can be offered must of necessity be on the scanty side, especially such evidence as bears only indirectly on the problem. For this reason some of the statements in the summary paper may appear unduly positive. This applies particularly to the statements regarding the Idaho batholith as a source of ore and the relationship between the monzonitic rocks in the Coeur d'Alene district and the rocks of the Idaho batholith.

The statement that the batholith has proven to be barren of mineral deposits, except pegmatites, comes after many years of trying to establish a genetic relationship between ores and the batholith. Like others, the writer began his studies in Idaho with the assumption that the Idaho batholith was the great "mineralizer." He was then surprised to find that the mineralization in district after district usually regarded as related to the batholith was more closely associated with intrusives younger than and apparently unrelated to the batholith and that the structural and textural characteristics of the deposits were incompatible with an origin in the batholith. So far no deposits have been observed that have a demonstrated source in the Idaho batholith, but the search continues and some such deposits may eventually be found.

As for the relationship between the monzonitic rocks of the Coeur d'Alene district and the granitic rock of the Idaho batholith, the writer can only repeat what he has said before; there is no petrographic resemblance between the Coeur d'Alene rocks and those of the batholith. Each has a strikingly different mineralogic-petrographic stamp, strongly suggesting that the rocks belong to

entirely different petrogenetic provinces. The differences between the Coeur d'Alene monzonite and other plutonic rocks in Idaho were pointed out by Stewart (1914) nearly 40 years ago, but apparently the writer is the only one who has since had occasion to work with these many and varied rocks.

Detailed study of the Coeur d'Alene district will add considerably to the understanding of structural, mineralogical, and petrological problems and those of ore genesis; but many of the problems are of regional scope and require studies far beyond the confines of the Coeur d'Alene district for their ultimate solution. Regardless of what may have been inferred in the original summary paper, the writer does not regard the basic problems as solved. Actually the problems increase in complexity as the studies continue and will require lengthy study before eventual solution. It is hoped that others may interest themselves in the problems and that the combined efforts of many may finally lead to a full understanding of the problems and their various ramifications. It is important, however, to take stock now and then to ascertain just what is known, what progress is being made, and to find out just what remains to be done. Progress comes with presentation and comparison of ideas and formulation of working concepts.

Literature Cited

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