

DISCUSSION.

THE WALLOWA BATHOLITH

In the October (1943) issue of *The American Journal of Science*, K. B. Krauskopf published a paper¹ on the Wallowa Batholith, and I was gratified to note his consideration of an attractive hypothesis of origin. A paragraph on page 627 contains this statement:

"The ultimate origin of the quartz-diorite is an elusive question to which data at present available cannot provide an answer. Perhaps the bulk of the material rose as a silicate melt from far below, as batholiths are traditionally supposed to do; no conclusive evidence can be cited against such a view. Since the borders of the intrusive show good evidence for widespread granitization, a more attractive hypothesis would be formation of the quartz-diorite by metasomatic alteration of metamorphic rock accompanied by some movement of the mass as a whole—essentially Goodspeed's idea, modified to eliminate its chief difficulties."

Krauskopf evidently believes that the "chief difficulties" are those relating to the formation of all the granodioritic rock by static metasomatism, and implies that the concept that metasomatism may have been accompanied by plastic flow is new. But in one of my previous papers² which was not quoted by Krauskopf, I suggested flowage of metamorphosed material. The second paragraph of this article on page 399 is as follows:

"There are several areas in the southeastern portion of the Wallowa Mountains of Oregon where by reason of steep glacial valleys or extensive mine workings there are excellent exposures of various kinds of metamorphic and plutonic rocks. Many of these field occurrences would suggest to the casual observer only the usual interpretation for the emplacement of the granodioritic masses, namely, injection accompanied by piecemeal stoping, with a minor amount of assimilation. However, critical field data obtained by the writer during the past ten years and substantiated by the petrographic study of several thousand thin sections have forced him to abandon the simple magmatic hypothesis for a more complex one of metasomatic replacement. By this interpretation, most of the granodioritic masses in the vicinity of Cornucopia are considered to be the end products of progressive metamorphism. However, there are a few occurrences which suggest that, locally, the newly formed products of metamorphism were subjected to a mass movement of plastic flow. Such newly formed magmatic material might be termed *neomagma* in contrast to *hypomagmas* of presumably deep-seated sources. In this region, numerous Tertiary basaltic dikes present excellent evidence of magmatic injection, and could, therefore, be termed orthomagmatic in origin."

¹ Krauskopf, K. B.: 1943. The Wallowa Batholith. *Amer. Jour. Science*, Vol. 241, pp. 607-628.

² Goodspeed, G. E.: 1939. Pre-Tertiary metasomatic processes in the southeastern portion of the Wallowa mountains of Oregon. *Proc. Sixth Pacific Science Congress*, pp. 399-422.

On page 417 of the same paper is this paragraph:

"At a very few localities in this region there are drawn-out inclusions and schlieren where the granodiorite intimately mixed with recrystallized hornfels has the appearance of complex flowage. The actual plastic flow of such a magma might be considered to be a neomagma, and of metamorphic rather than of orthomagmatic origin. In some regions the amount of plastic flow of granite material may be large, but in the vicinity of Cornucopia the evidence to date indicates that it was small. However, in this region there is much cogent evidence to the effect that metasomatic replacement played a most important role in the emplacement of large granodioritic masses."

The concluding paragraph on page 421 is:

"In this part of the Wallowa Mountains, such evidence as the contact relations, and the presence of undisturbed relics of inclusions, suggest that granitization took place passively and without mass movement. It might be expected that in some regions recently granitized material might be subjected to plastic flow and hence become a neomagma. Granite and granodiorite formed as a result of the injection of neomagma would of course show those structures which are characteristic of flowage."

Having recently had the opportunity to see some of the relatively large laccoliths of the Little Belt mountains of central Montana, I was impressed with evidence of orthomagmatic injection of these syenitic and granitic bodies in contrast to the plutonic masses in the southeastern portion of the Wallowa mountains of Oregon. However, many of these Montana intrusive bodies are by no means simple, and I should hesitate to advance simplicity of composition and texture (as Krauskopf does) as criteria against metasomatic origin.

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