

DALTON HIGHWAY, YUKON RIVER TO PRUDHOE BAY, ALASKA

**Bedrock geology of the eastern Koyukuk basin,
central Brooks Range, and eastcentral Arctic Slope**

Edited by Charles G. Mull and Karen E. Adams

Artwork and production coordinated by Ann-Lillian Schell

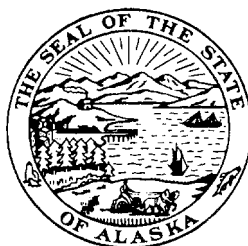
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CHAPTER 11.

REGIONAL SIGNIFICANCE OF THE JIM RIVER AND HODZANA PLUTONS

By J.D. Blum,¹ J.T. Dillon,² and A.E. Blum³

INTRODUCTION

The Jim River and Hodzana plutons (figs. 58 and 155) are two of many Lower Cretaceous plutons that intruded the Ruby geanticline. The Jim River pluton also intruded the narrow band of Devonian to Jurassic oceanic crustal rocks of the Angayucham terrane that separates the Precambrian to lower Paleozoic metasediments of the Ruby geanticline from the Cretaceous sediments and volcanic-arc rocks of the Yukon-Koyukuk basin. The Hodzana pluton intruded both the Angayucham terrane and metasedimentary rocks of the Ruby geanticline about 110 Ma, thus stitching the terranes together.

Reconnaissance studies of other Cretaceous plutons in northcentral Alaska have shown distinct compositional and isotopic differences between the plutonic rocks that intruded the Ruby geanticline and those that intruded the Yukon-Koyukuk basin (Arth and others, 1984; Miller, 1984; Puchner, 1984). Plutons of the Ruby geanticline are 104 to 111 m.y. old, are composed of biotite and two-mica granite, have initial $^{87}\text{Sr}/^{86}\text{Sr}$ values of 0.706 to 0.730 and $\delta^{18}\text{O}$ values >8.5 . Plutons of the western Yukon-Koyukuk basin are 99 to 110 m.y.

old, are composed of hornblende-pyroxene monzonite, syenite, quartz monzonite, and associated subsilicic alkaline phases, and have no reported isotope values. Plutons of the eastern Yukon-Koyukuk basin are 80 to 84 m.y. old, are composed of hornblende-biotite tonalite, granodiorite, and granite, and have initial $^{87}\text{Sr}/^{86}\text{Sr}$ values of 0.7038 to 0.7047 and $\delta^{18}\text{O}$ values <8.5 .

Arth and others (1984) and Miller (1984) concluded that significant amounts of continental crust were either the source of or were incorporated into the magmas of plutons that intruded the Ruby geanticline. They also concluded that plutons which intruded the eastern Yukon-Koyukuk basin are characteristic of island-arc or convergent continental-margin magmatism and that plutons which intruded the western Yukon-Koyukuk basin are enigmatic in origin. An important question is whether compositional differences between the Lower Cretaceous plutons of the Ruby geanticline and those of the western Yukon-Koyukuk basin are due to magma generation by different processes or result from similar magmas that assimilated different types and amounts of crustal rock during intrusion.

RESULTS OF STUDY

A petrologic and isotopic investigation of the Jim River and Hodzana plutons was initiated to test the importance of wall rock assimilation on the composition and isotopic signature of the Lower Cretaceous plutons.

Preliminary data are reported below; details are reported by Blum and others (1987). Modal volume and field data show that most of the Jim River pluton is composed of biotite-amphibole-pyroxene syenite and monzonite, with a central core of biotite-amphibole granite; the northwestern Hodzana pluton is composed of biotite-amphibole monzodiorite and granite. Twenty K-Ar age determinations from biotite and amphibole of the Jim River and Hodzana plutons range from 103 to 111 Ma and average 106 ± 6 Ma. A three-point whole-rock Rb-Sr isochron for the Jim River pluton yields an age of 111 Ma and an initial $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.7079. A five-

¹DGGS, 3700 Airport Way, Fairbanks, Alaska 99709. Current address: Department of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91125. Deceased; formerly of DGGS, 3700 Airport Way, Fairbanks, Alaska 99709.

³Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06511.

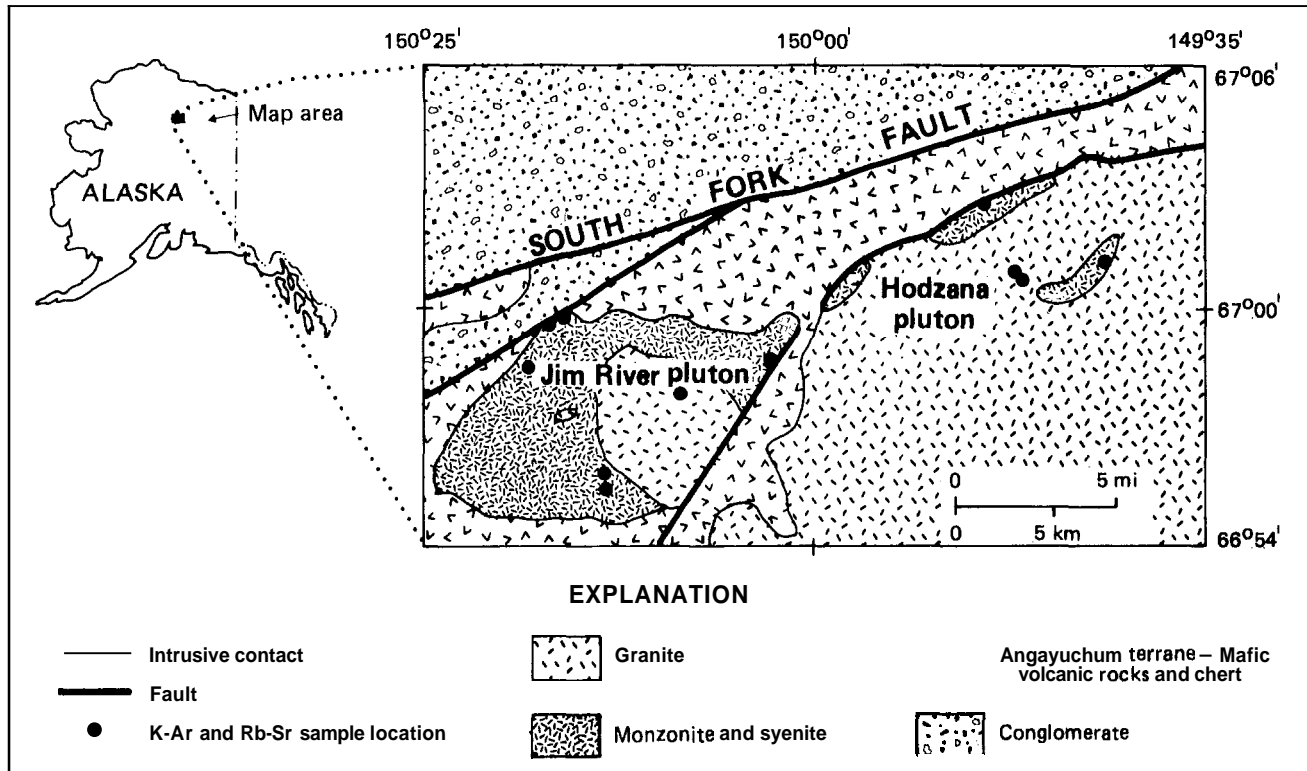


Figure 155. Generalized geologic map of the Jim River-Hodzana plutons area. Map modified from Blum and others (1987).

point whole-rock Rb-Sr isochron for the Hodzana pluton yields an age of 108 Ma and an initial $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.7078. Three whole-rock $\delta^{18}\text{O}$ values for the Jim River and Hodzana plutons range from 6.75 to 7.30.

These data indicate that the Jim River pluton and northwestern Hodzana pluton have different compositions, lower initial $^{87}\text{Sr}/^{86}\text{Sr}$ values, and lower $\delta^{18}\text{O}$ values than most of the other Lower Cretaceous plutons that intruded the Ruby geanticline. They are more similar, compositionally and isotopically, to the plutons that intruded the Yukon-Koyukuk basin. The unique syenitic to monzonitic composition of the Jim River pluton may represent a more primary mantle-derived magma that underwent minor contamination where it intruded oceanic rocks of the Angayucham terrane and severe contamination where it intruded continental

rocks of the Ruby geanticline. This may help to explain why mostly syenitic to monzonitic magmas are found in the Angayucham terrane, mostly monzodioritic magmas are found in the transition zone, and mostly granites are found in the Ruby geanticline.

Contact relationships at the present depth of exposure suggest that wall rock assimilation was severe where the Hodzana pluton intruded the Ruby geanticline and minimal where the Hodzana and Jim River plutons intruded the Angayucham terrane. Wall rock composition and the amount of assimilation appear to be controlling factors in the composition and isotopic signature of the plutons. These plutons may record a transition in magma composition at the terrane boundary between the Angayucham terrane and the Ruby geanticline.