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Isochron/West, Bulletin of Isotopic Geochronology, v. 23, pp. 29-31

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PRE-TERTIARY VOLCANIC ROCKS IN CENTRAL IDAHO

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INTRODUCTION

Newly determined Cretaceous K-Ar and Rb-Sr ages for a pluton that intrudes a series of pervasively altered volcanic rocks in central Idaho confirm the inference based on field study that these rocks are of pre-Tertiary age. The volcanic rocks may be cogenetic with the Idaho batholith. Discordant Eocene fission-track ages show that these rocks have had a complex post-emplacement thermal history that most probably is related to nearby Eocene volcanic activity.

These volcanic rocks are now known to occur in the vicinity of Mt. Jordan located about 31 km northeast of Stanley, in western Custer County (fig. 1). In that area they are overlain by and faulted against less altered silicic volcaniclastic rocks and sediments of the Eocene Challis Volcanics. It is probable that similar pre-Tertiary volcanic rocks occur elsewhere in central Idaho, but either have been included in the Challis Volcanics or locally in the now-abandoned "Casto Volcanics" of Ross (1934).

Acknowledgments. This article was reviewed by S. W. Hobbs and Z. E. Peterman.

PRE-TERTIARY VOLCANICS

Exposures on the ridges bordering upper Jordan Creek, on the southeast flank of Mt. Jordan, and on Mt. Jordan itself reveal a sequence at least 450 m thick of pervasively altered, greenish-gray weathering lavas and interbedded volcaniclastic rocks. Textures and phenocryst pseudomorphs suggest that the rocks originally were andesitic. The alteration assemblage includes chlorite, carbonate, epidote, leucoxene, and quartz. On the east flank of Mt. Jordan, the lavas contain podlike, rounded inclusions of graphitic quartzite that are several meters to tens of meters across. The quartzite is similar to that which crops out a few kilometers to the south, where it has been called Wood River Formation (Pennsylvanian and Permian) by Anderson (1949). The volcanic rocks are intruded by an intricate, irregular network of rhyolite dikes and sills that are themselves altered to the same degree as the volcanic rocks they intrude. Quartz phenocrysts and pink feldspar pseudomorphs are common in these rocks. Matrices often are recrystallized to relatively coarse myrmekitic quartz-feldspar intergrowths that also may contain patches and shreds of sericite. These altered dikes and sills are easily distinguished from the shallow-level Eocene intrusions in the area to the south and east (fig. 1), which often contain fresh glass and have regular, easily mappable outlines.

Reconnaissance shows that the pre-Tertiary volcanic sequence of upper Jordan Creek continues northward into the drainage of the west fork of Mayfield Creek, into the area mapped by Stiles (1976).

GRANITIC PLUTON

In the vicinity of Mt. Jordan, a gray biotite quartz monzonite pluton intrudes the pre-Tertiary volcanics. The intrusive relations are best seen in the walls of the cirque on the north side of the peak, where irregular apophyses of the intrusion cut the volcanics. Toward the north and northeast, the intrusion is filled with swarms of stoped blocks of volcanic rock and is itself intensely chloritized, apparently by volatiles introduced by the stoped blocks.

Chloritization near the contact made it difficult to find material suitable for K-Ar dating. Nevertheless, it was believed desirable to collect as close to the contact as practical to remove any doubt that the sample collected was indeed from the same pluton as that intruding the volcanics. A small area less chloritized than most was sampled; careful mineral separation concentrated the biotite and removed most of the chlorite. Both K-Ar and Rb-Sr measurements were made on the biotite. In addition, fission-track measurements were made on sphene, zircon, and apatite in the same sample.

DISCUSSION

Opinion has varied during the past several years concerning the presence of pre-Tertiary volcanics in central Idaho. Originally, Ross (1934) recognized what he believed to be a pre-Tertiary volcanic unit in central Idaho, which he named the "Casto Volcanics." Ross believed these rocks might be as old as Permian, long predating the Idaho batholith. In the area near Big Creek, Leonard (1962) recognized *two* pre-Tertiary, pre-batholith volcanic units. Leonard correlated the younger of the two, thermally metamorphosed by the batholith but little deformed, with the "Casto Volcanics" of Ross.

Hamilton and Myers (1967, p. C6), noting the general lack of deformation in Ross' "Casto Volcanics" and their spatial association with the Idaho batholith that intrudes them, speculated that the volcanics might be genetically related to the batholith. Later in the same paper (1967, p. C30), an appended note indicated that more recent field work had shown Ross' "Casto Volcanics" actually to be Eocene Challis Volcanics metamorphosed by an Eocene granitic pluton. This newer work was more fully reported in Cater and others (1973), who added that Ross' own mapping did not, in their view, consistently distinguish "Casto Volcanics" from Challis Volcanics and recommended that the name "Casto Volcanics" be abandoned.

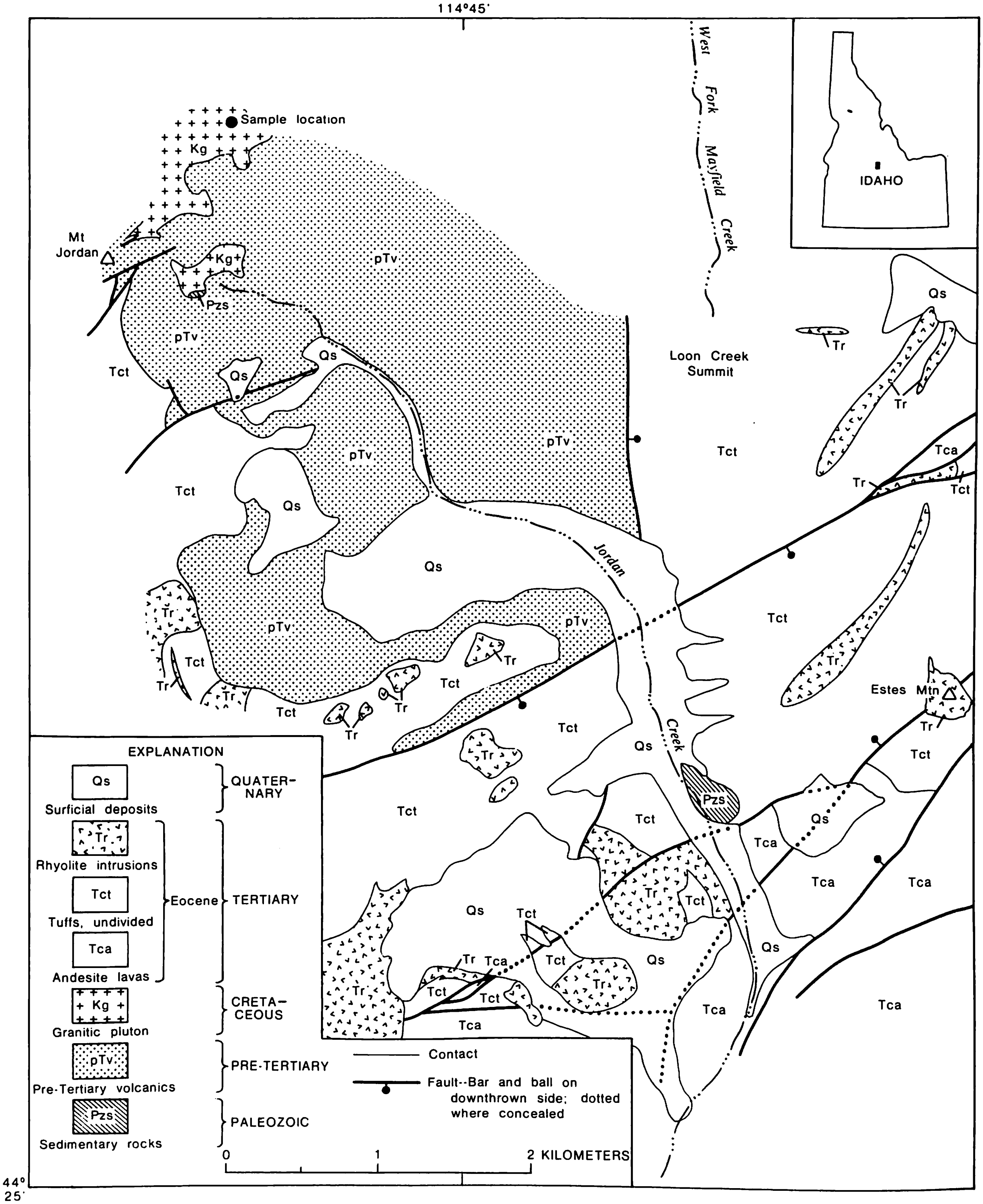

FIGURE 1. Generalized geologic map of the Mt. Jordan area, central Idaho (McIntyre, unpub. data; base maps are Custer and Mt. Jordan quadrangles, Idaho, 1:24,000).

Evidence presented below shows that pre-Tertiary volcanic rocks, intruded by Cretaceous granitic rocks, do indeed exist locally in central Idaho. It, therefore, resurrects the problem of distinguishing volcanic rocks such as these that may occur elsewhere from those discussed by Cater and others (1973). The problem arises because of (at least) two similar cycles of volcanism and genetically related granitic plutonism having taken place in the same region. As is often the case, evidence for the older event is readily masked by the younger. Locally too, as noted by Leonard (1962), a third, more highly deformed, metavolcanic unit also may be present.

The only facts known about the age of the volcanic rocks in the Mt. Jordan area are that they have been intruded by Cretaceous granitic rocks and that locally they contain quartzite inclusions of probable late Paleozoic age. An inference can be made, however, from the rock sequence—intermediate volcanics permeated by silicic dikes and sills and invaded by a granitic pluton—which appears in itself to suggest that the volcanic rocks are genetically related precursors of the pluton that intruded them. These rocks may represent a remnant of the volcanics associated with the Idaho batholith originally sought by Hamilton and Myers (1967). Other, similar remnants surely will be found elsewhere. Two possible candidates are the little-deformed, altered volcanics in the Big Creek area near McFadden Point (Leonard, 1962; oral commun., 1968) and the volcanic host rocks for the fluorite veins at Meyers Cove.

SAMPLE DESCRIPTION

USGS (D) MY–508 K-Ar, Rb-Sr, Fission-track

Quartz monzonite (44°28′44″N, 114°46′09″W; NE side of Mt. Jordan, elev. 2,600 m, Mt. Jordan 7.5′ quad., Custer, Co., ID). *Analytical data:* K-Ar (biotite) K_2O = 6.12, 6.13%, $*Ar^{40}$ = 6.652 x 10^{-10} mol/g, $Ar^{40}/\Sigma Ar^{40}$ = 88%; K^{40} = 1.167 x 10^{-4} atomic percent abundance; $K^{40}\lambda_{\Sigma}$ = 0.581 x 10^{-10}/yr, λ_{β} = 4.962 x 10^{-10}/yr. Rb-Sr (biotite) Rb = 428 ppm, Sr = 38.8 ppm, Rb^{87}/Sr^{86} = 32.08; Sr^{87}/Sr^{86} = 0.7390. Rb^{87} = 0.2783 gm/gm Rb, λ = 1.42 x 10^{-11}/yr. Fission-track (sphene) ρs = 9.92 x 10^6 tracks/cm^2 (1,700 tracks counted), ρi = 11.75 x 10^6 tracks/cm^2 (1,006 tracks counted), ϕ = 1.04 x 10^{15} neutrons/cm^2, U = 325 ppm; (zircon) ρs = 6.35 x 10^6 tracks/cm^2 (1,264), ρi = 9.89 x 10^6 tracks/cm^2 (984), ϕ = 1.05 x 10^{15} neutrons/cm^2, U = 270 ppm; (apatite) ρs = 0.427 x 10^6 tracks/cm^2 (889), ρi = 0.840 x 10^6 tracks/cm^2 (1,749), ϕ = 1.28 x 10^{15} neutrons/cm^2, U = 19 ppm. λ_F = 7.03 x 10^{-17}/yr. (Analytical uncertainty is listed as 2σ). *Analysts:* R. F. Marvin, H. H. Mehnert, V. M. Merritt (K-Ar); C. E. Hedge, Kyota Futa (Rb-Sr); and C. W. Naeser (fission-track) *Collected by:* D. H. McIntyre. *Comments:* The K-Ar and Rb-Sr measurements gave concordant results near 74–75 m.y. that demonstrate a Cretaceous age for the pluton. The fission-track determinations document an important heating event that raised rock temperatures in the area to about 200–250° C and ended about 40 m.y. ago. It is very likely that this heating event accompanied emplacement of Eocene rhyolite dikes, plugs, and extrusive domes that have been mapped in the area a few kilometers to the south and east (fig. 1). This heating event may also have caused some loss of radiogenic argon and strontium in the biotite of the pluton at Mt. Jordan, and thus may explain why the K-Ar age of 74 m.y. is much younger than ages determined for Idaho batholith outcrops along the Salmon River to the south (79–95 m.y.; Armstrong, 1975). Both the K-Ar and Rb-Sr results should be interpreted as minimum ages. Nevertheless, they clearly demonstrate a pre-Tertiary age for the quartz monzonite pluton and the volcanic rocks that it intrudes.

(assumed initial Sr^{87}/Sr^{86} of 0.705±0.001)
(biotite) 7.39±2.5 m.y. (K-Ar)
(biotite) 74.7±2.5 m.y. (Rb-Sr)
(sphene) 52.4±2.4 m.y. (fission-track)
(zircon) 40.2±1.8 m.y. (fission-track)
(apatite) 38.8±3.2 m.y. (fission-track)

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