URANIUM, THORIUM, AND MERCURY DISTRIBUTION THROUGH THE EVOLUTION OF THE McDERMITT CALDERA COMPLEX

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ABSTRACT

The McDermitt caldera complex developed over a period of 5 m.y. during which ash-flow tuff sheets anomalous in mercury, uranium, and thorium were emplaced. The moat portions of the caldera complex were subsequently filled with tuffaceous sediments. Late in the caldera development near-surface intrusives and domes were emplaced along the margins of the complex and mineralized with uranium. Seven large hydrothermal systems developed at this time and formed large areas of alteration within the caldera-fill volcanics and sediments. Five of the altered zones are associated with economic concentrations of uranium and/or mercury.

INTRODUCTION

The McDermitt caldera complex is a large Miocene collapse structure consisting of nested and overlapping calderas. The calderas occur along the Nevada-Oregon border (Fig. 1) and occupy the Trout Creek, Double H, and Montana Mountains. Ore deposits of mercury with appreciable concentrations of uranium (Rytuba, 1977) and uranium ore deposits which include a recently discovered ore body in caldera-fill volcanics occur within the complex. Potentially economic concentrations of lithium also occur within the caldera-fill sediments and constitute a major lithium resource within the United States (Glanzman, Rytuba, and McCarthy, 1978; Rytuba and Glanzman, 1978).

CALDERA EVOLUTION

The caldera complex developed over an interval of 5 m.y. during which large volumes of peralkaline rhyolitic magma were erupted. Five large-volume, greater than 24 mi\textsuperscript{3} (100 km\textsuperscript{3}), ash-flow tuffs were vented during this interval resulting in the formation of five calderas (Fig. 2). The initial ash-flow tuff, unit 1, is a simple cooling unit with a maximum thickness of 755 ft (230 m). It occurs to the south and east of the complex (Fig. 3). Following eruption of unit 1, small-volume ash-flow tuffs with a combined thickness of 30 ft (9 m) were erupted. The second large-volume ash-flow tuff, unit 2, is present in the same area as unit 1 and has a maximum thickness of 690 ft (210 m). One of the vent areas for this tuff is located in the northeastern part of the Double-H Mountains (Fig. 4). Shortly after the cooling of unit 2, ash-flow tuff 3 was erupted at 17.5\textpm 0.3 m.y. It is present in the southern and eastern part of the complex (Fig. 5) and has a minimum thickness of 213 ft (65 m).

Large-volume explosive volcanic activity then ceased for a period of 2 m.y. Volcanic activity during this interval consisted of small-volume air-fall tuffs and ash-flow tuffs of limited extent. The resumption of large-volume explosive volcanism began at 15.8\textpm 0.3 m.y. with the eruption of two ash-flow tuff sheets, 4 and 5, with a combined thickness in excess of 394 ft (120 m). Although the units were emplaced in a short time interval, they cooled separately and are simple cooling units. Units 4 and 5 are present principally in the north part of the complex (Fig. 6), but a small stratigraphic section of both units occurs in a fault block along the caldera wall in the south part of the complex.

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