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GEOLOGY OF THE ROCK CANYON CREEK FLUORITE/RARE EARTH ELEMENT SHOWING SOUTHERN ROCKY MOUNTAINS* (82J/3E)

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INTRODUCTION

The Rock Canyon Creek showing (Candy and Deep Purple claims) is hosted by Middle Devonian carbonate rocks in the southern Rocky Mountains of British Columbia. The property lies near the headwaters of Rock Canyon Creek (Figure 4-2-1) in the eastern White River drainage, approximately 40 kilometres east of the town of Canal Flats. It is accessible by conventional vehicles along the White River and Canyon Creek forestry roads, which join Highway 3A, 2 kilometres south of Canal Flats. The main mineralized zone lies between the 1525 and 2000-metre elevations in a valley that has been burnt over and subsequently been logged. Access is excellent, but exposure poor due to thick glacial drift cover.

The Rock Canyon Creek prospect was discovered in 1977 during a regional exploration program carried out by Riocanex (then Rio Tinto Canadian Exploration Ltd.), in search of Mississippi Valley-type lead-zinc mineralization (C. Graf, personal communication, 1986).

Between 1977 and 1979, mapping, soil and rock geochemistry and trenching were done to assess the fluorspar-lead-zinc potential of the property (Bending, 1978; Alonis, 1979). More recent work (Graf, 1981; personal communication, 1986) attempted to establish the economic potential of the property in terms of other commodities. It was during this latter work that the anomalous rare earth element (REE) content of claims was recognized.

GEOLOGY AND MINERALIZATION

The Rock Canyon Creek area is underlain by a Cambro-Ordovician to Middle Devonian carbonate-dominated sequence (Leech, 1979; Mott *et al.*, 1986). The regional stratigraphy has been previously described by Mott *et al.* (1986) and only relevant points will be reiterated here. The southwestern boundary of the property is marked by a west-dipping thrust fault which places Cambrian and Ordovician strata over younger rocks (*see* Figure 4-2-1). The remainder of the area is underlain by an overturned to upright homoclinal sequence, younging to the east. This succession comprises coral-rich limestones of the Ordovician Beaverfoot Formation in the northwest, unconformably overlain by buff-weathering dolomites and gypsum solution breccias of the basal Devonian unit which are, in turn, conformably overlain by fossiliferous and nodular grey limestones of the Fairholm Group. The fluorspar and REE mineralization is stratabound, hosted mainly by the basal Devonian unit.

Four main types of fluorite mineralization can be identified in the field. The first and most widespread consists of disseminations and fine veinlets of dark purple fluorite in a dark brown to dark orange-brown-weathering dolomitic carbonate matrix. Fluorite content generally varies from 2 to greater than 10 per cent of the rock. Disseminated pyrite, bastnaesite ($CeCO_3F$), gorceixite [(Ba, Ca, Ce)Al_3 $(PO_4)_2$ $(OH)_5 \cdot H_2O$] and barite are common accessory minerals (Hora and Kwong, 1986). Neutron activation analyses of up to 2.3 per cent rare earth elements and 2.7 per cent barium have been reported (C. Graf, personal communication, 1986). Niobium, strontium and yttrium are also present in measurable amounts (Hora and Kwong, 1986). Contacts between mineralized and unmineralized dolomitic rocks are gradational. This type of mineralization defines a northwest-trending zone mappable for over a kilometre subparallel to strike (Figure 4-2-1).

The second type of mineralization consists of massive, fine-grained purple and white fluorite, which commonly comprises greater than 40 per cent of the rock, together with accessory barite and prosopite [$CaAl_2$ (F, $OH)_8$] (Hora and Kwong, 1986). The rare earth element and pyrite contents of these rocks are relatively low. Massive fluorite mineralization has not been found in place, but relatively abundant float occurs at the southeast end of the zone of Type 1 mineralization, near the north-flowing branch of Rock Canyon Creek (Figure 4-2-1).

Fine-grained purple fluorite disseminated in white gypsum and locally interbedded with buff-weathering dolomite constitutes the third type of mineralization. Fluorspar is present in concentrations from trace amounts to a few per cent. Minor rare earth element enrichment is also reported (C. Graf, personal communication, 1986). This type of mineralization is found randomly distributed throughout the basal Devonian unit.

The fourth type of fluorspar mineralization occurs in rocks tentatively assigned to the Devonian Fairholm Group and is found in one locality, at the 2135-metre elevation on the ridge east of the headwaters of Rock Canyon Creek (Figure 4-2-1). Massive purple fluorite forms the matrix of an intraformational conglomerate and constitutes greater than 20 per cent of the rock.

DISCUSSION

A carbonatite-related origin has been suggested for the Rock Canyon Creek fluorite/rare earth showing (C. Graf, personal communication, 1986; Hora and Kwong, 1986). This interpretation appears consistent with preliminary geochemical data, which in addition to high fluorine, REE and barium, show enrichment in niobium, strontium, yttrium and phosphorus (C. Graf, personal communication, 1986; Hora and Kwong, 1986). Chondrite normalized rare earth element abundance patterns fall within the field defined by other British Columbia carbonatites (Figure 4-2-2);

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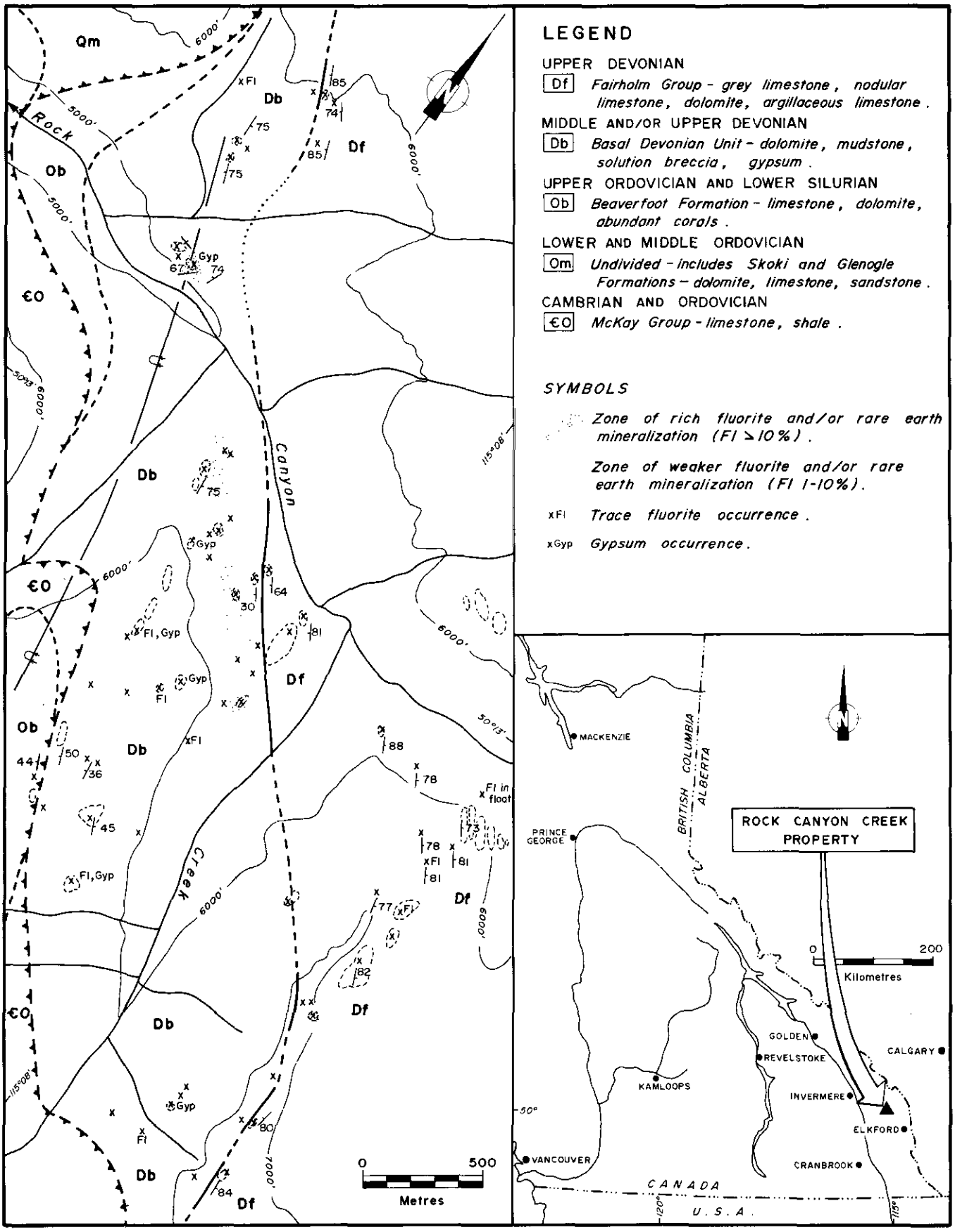

Figure 4-2-1. Geology of the Rock Canyon Creek fluorite/rare earth showing.

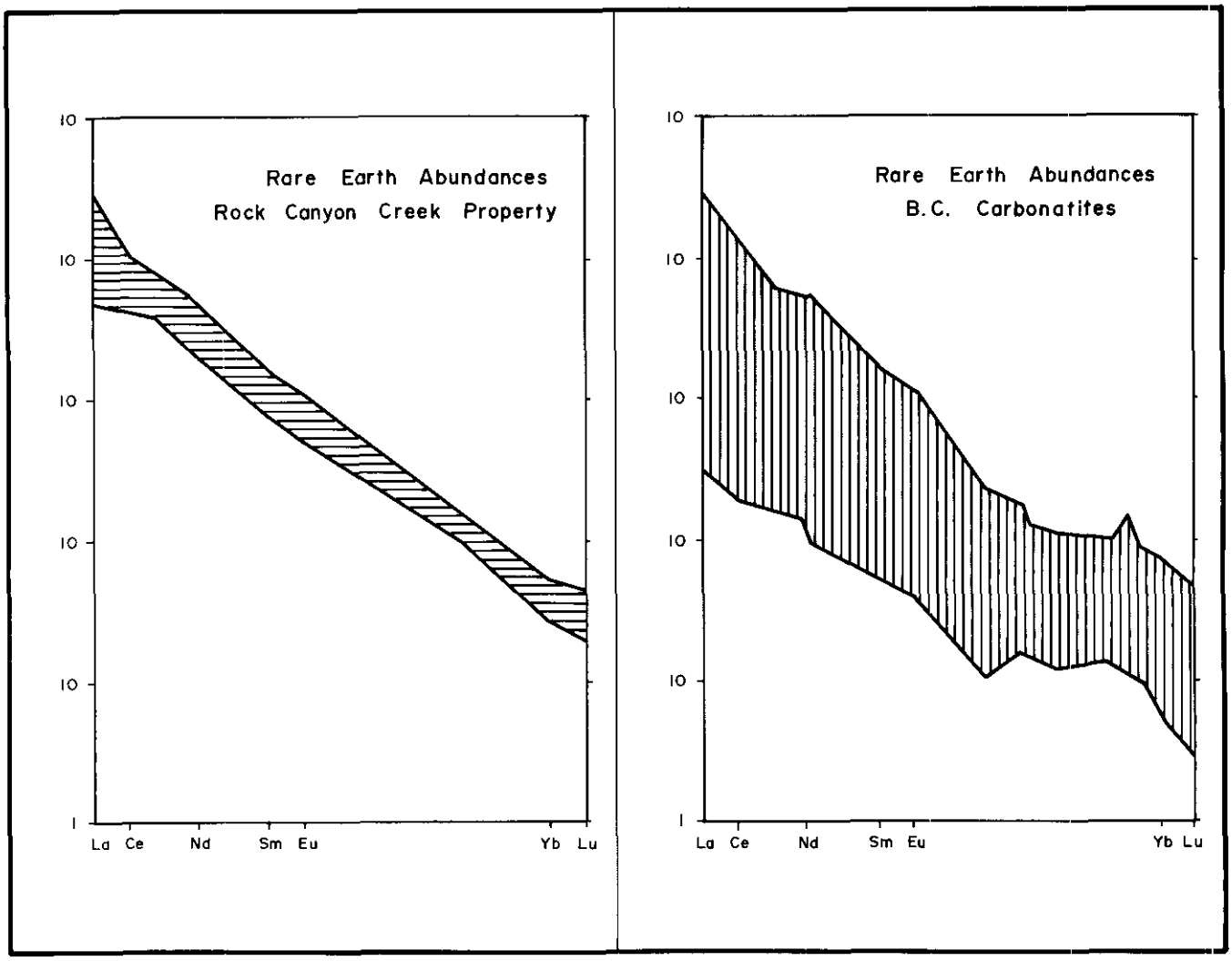

Figure 4-2-2. (A) Chondrite normalized REE plot of samples of Type 1 fluorite/rare earth element mineralization. Rare earth values from C. Graf (personal communication, 1986); chondrite normalizing factors from Henderson (1984, page 10). (B) Field of chondrite-normalized REE values for British Columbia carbonatites. Data from Pell (1986a; in preparation) and Höy and Pell (1986).

however the Rock Canyon Creek showing is more enriched in rare earths than most other examples, comparable only with the REE sweats and dykes associated with the Aley Complex (Pell, 1986a; Mäder, this volume).

Although a carbonatite-related origin appears to be the most reasonable interpretation, the timing and actual mode of formation have yet to be established. Two possibilities exist for the mode of formation of the main Type 1 mineralized zone: (1) carbonatite dykes or (2) metasomatically altered (fenitized) Devonian carbonate rocks, possibly associated with a deep-seated carbonatite intrusion. The latter interpretation is preferred due to the lack of unequivocal igneous material and the gradational contacts with fresh carbonates. Timing of metasomatism (or carbonatite intrusion) is also poorly defined. Mineralization apparently occurred prior to the Jura-Cretaceous deformation, as no fluorite is observed west of the west boundary fault, and postdated at least part of the deposition of the basal Devonian unit. This broadly defines a time span of 280 million years during which mineralization must have occurred. Some mineralization (Types 3 and 4, fluorite associated with solution breccias and intraformational conglomerate matrix) may have resulted from elemental remobilization, and therefore postdate the Type 1 and 2 fluorite/rare earth deposits. It has been suggested that mineralization may have been synchronous with deposition of the basal Devonian unit (C. Graf, personal communication, 1986). A slightly younger age seems probable as most other carbonatites in the province are Devono-Mississippian to Early Mississippian (*circa* 350 million years) in age (Pell, 1986b). Additional research is currently in progress to help resolve some of these ambiguities.

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