

Volcanological Context and Setting of the Crowsnest Formation, Alberta. A Cataclysmic Event?

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An alkaline magmatic province exists in Southwestern Alberta and the adjacent region in British Columbia. Rocks generally classify as undersaturated, trachyte-syenite compositions. Intrusive rocks occur at Commerce Mountain and Rainy Ridge, as well as the Howell Creek - Trachyte Ridge area. The Crowsnest volcanic suite is extrusive and overwhelmingly dominated by pyroclastic and related epiclastic rocks. These were deposited at the top of the terrestrial Blairmore Group immediately prior to inundation of the area by the Western Interior Seaway. While genetically similar in many respects, a direct relationship and timing of the aforementioned rocks is still allusive. Age determinations range between 75 and 150 Ma for this alkaline magmatic province.

The Crowsnest Formation is dominated by pyroclastic deposits and lesser epiclastic derivatives. At its principle reference section, it is divided into a lower and upper member, based on gross lithology and depositional characteristics. Intrusive and effusive rocks are extremely rare. The lower member is recessive and characterized by crystal clast-rich, well-bedded pyroclastic rocks that were emplaced by subaerial fallout, pyroclastic surges, block and ash flows, and lahars. Bedforms and depositional features are enhanced by the black andradite garnet crystal clasts. The upper member is resistant and is composed of dark green, massive, thickly-bedded pyroclastic breccia deposits.

Primary rocks are represented by juvenile and cognate rock fragments present in most deposits. A characteristic feature of the Crowsnest formation is the coarsely crystalline nature of the porphyritic rock fragments, and to a lesser degree, crystal clasts.

Three compositions have been identified from rock fragments: sanidine-andradite trachyte (potassic: sanidine, Ti-andradite phenocrysts \pm aegirine-augite, titanite, apatite), sanidine-andradite-analcime phonolite (intermediate: sanidine, analcime and andradite phenocrysts \pm aegirine-augite, titanite, apatite) to analcime tephriphonolite (sodic: dominated by analcime with subordinate to rare sanidine and andradite phenocrysts \pm aegirine-augite, titanite, apatite). New evidence suggests a fourth, strongly potassic composition for the upper member.

Exposures of the formation under-represent the volume and extent of the lower member which is recessive. Deposits indicate that this member expresses the onset of volcanism from a trachyte melt, depositing classical pyroclastic deposit types. However, the upper member demonstrates a significant change in eruption and it is postulated that a cataclysmic event that deposited widespread breccia marked the end of Blairmore time, followed by a rapid inundation of the Western Interior Seaway. The eruption of both members is postulated to have occurred over a short time period and may have been relatively continuous.