Birch Island

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its. Such deposits vary in age from Lower Proterozoic to Mesozoic. They are generally composed of disseminated sulphides, which occur in quartz sandstones in a transgressive sequence deposited in either a fluvio-continental or a shallow water marine environment. Marine sediments are usually present in the upper parts of the sequences, but examples exist where such sediments are absent (*e.g.*, Yava Deposit, Nova Scotia). The mineralized sediments are typically grey to white in colour, indicating relatively reducing conditions.

In one model, the mineralizing solutios are brines expelled from the sedimentary sequence during compaction. They migrate along permeable strata (such as sandstone beds) towards the edge of the basin. Another model (preferred by Bjorlykke and Sangster, 1981) proposes the weathering of the source rocks and the transport of the metals by meteoric water circulating in aquafers towards the sedimentary basin. In both models, metal deposition occurs in porous strata when the physico-chemical conditions become reducing, due for example to the presence of reduced sulphur. A possible source for the lead is the potassic feldspar in the granitic basement, especially if these rocks are relatively enriched in Pb. Another possible source would be potassic volcanic rocks or arkoses if these are present in the supracrustal sequence and available for weathering.

The Wakeham Terrane displays several of the characteristics favourable for sandstone-hosted Pb-Zn deposits, for example, a continental rift context, suitable sources for Pb (granitic basement, arkoses and potassic volcanic rocks), and aquifers. The Wakeham Terrane contains few carbonate rocks, suggesting that a generalized marine invasion was unlikely. Nevertheless, there are sporadic horizons of calcareous sandstone, local inclusions of crystalline limestone in gabbro (Claveau, 1949), and a marker unit of black to dark grey schist and pink crystalline limestone in the eastern sector of the Wakeham Terrane (Sharma, 1973). These occurrences suggest that marine conditions may have existed locally. Horizons of dark grey to black schist near the base of the Davy Group and intercalated with the sandstones elsewhere in the sequence indicate that reducing conditions favourable for sulphide deposition were present locally. Red-beds, a potential source of copper, appear rare.

From an exploration point of view, it is interesting to note that a lake bottom geochemical survey (Pelletier, 1986) has revealed, in the southern part of the area, a 20 km-long Pb anomaly parallel to the stratification in the Davy Group (Figure 2). The cause of this anomaly is not known. Because of its large size and its stratiform shape, this anomaly warrants further study in the field. Lake bottom sediments also suggest that the basement gneisses southeast of the Wakeham Terrane, a potential source area, are enriched in Pb.

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PHANEROZOIC ANALOGUES of Olympic Dam-type Deposits in the Canadian Cordillera

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There has been little exploration for Olympic Dam-type deposits in the Canadian Cordillera which can be readily attributed to a limited exposure of Precambrian rock sequences. In addition, clearly analogous mineral occurrences are few (Wernecke Breccias, Thorkelson and Wallace, 1993) and showings which represent possible analogues are poorly documented (Falcon, MINFILE 093O-016; Iron Range MINFILE 082F 014 to 082F 028). However, a series of partially explored deposits and showings in south-central British Columbia may represent Phanerozoic analogues of Proterozoic Olympic Dam-type deposits.

Birch Island District

The Birch Island district is located 330 kms northeast of Vancouver and 20 kms southeast of Clearwater. Showings were first discovered in 1918 on Red Ridge, 5 kms south of the village of Birch Island. The prospects had been intermittently evaluated for their silver, lead, fluorite and manganese potential until 1949, when the presence of uranium was recognized. Extensive surface and underground work outlined the Rexspar deposit as three zones of uranium ore and one zone of fluorite mineralization. By 1976, published reserves stood at 1 114 158 tonnes of ore grading 0.773 kilograms of U_3O_8 per tonne and 1 441 820 tonnes of ore grading 23.46% CaF_2.

Mineralization is hosted in strongly foliated volcanic rocks of the Devono-Mississippian Eagle Bay Formation in which protolith dacitic and andesitic volcanic breccias are generally preserved as varieties of chloritic and sericitic schists (Preto, 1978; Schiarizza and Preto, 1987; Pell, 1992). Interbedded metasedimentary rocks are now preserved as phyllite, slate, quartzite and ribbon chert. The immediate host rocks to mineralization are deformed and metamorphosed lithic tuffs and breccias of trachytic to rhyolitic composition, which include coarser fragmental and probable intrusive phases in the vicinity of the deposits. The local geological setting is interpreted as a volcanic vent.

Three main zones of uranium mineralization define a semicircular ring surrounding the fluorspar zone and locally overlying it. Ore zones typically occur as a series of discontinuous lenses generally less than 20 m thick and as much as 130 to 140 m long. Lenses are conformable with the schistosity in the trachyte-rhyolite host rocks. Replacement pods and aggregates, and fracture-filling textures are typical of most mineralization, although much of the A zone consists of well-banded pyrite-rich rocks with textures not unlike those found in volcanogenic massive sulphide deposits. Banded pyrite-fluorite and pyrite-fluorite-mica rocks locally show contorted bedding, fragmented sulphide layers and sulphide clasts. Fluorite veins cut this layered mineralization.

Uranium-thorium mineralization is associated with broad zones of fluorphlogopite and pyrite with lesser fluorite and minor calcite. Uranium minerals are uraninite, thorian uraninite, torbernite, metatorbernite, thorianite and thorite. Other minerals include monazite, bastnaesite, niobian ilmenorutile, pyrite, fluorphlogopite, apatite, fluorite, celestite, galena, sphalerite, chalcopyrite, molybdenite, scheelite, siderite, dolomite, calcite, barite, quartz, albitic plagioclase and alkali feldspar. Thorium-uranium ratios range from 1:1 to 5:1. Cerium and lanthanum generally grade better than 0.1% in ore samples. Magnetite and hematite are conspicuously absent, and the deposits did not generate anomalies in a 1973 government aeromagnetic survey. However, the abundance and widespread distribution of pyrite within and surrounding the four ore zones demonstrates a high iron content. The presence of pyrite indicates a high sulphur fugacity and a reducing depositional environment that may be specific to this site.

Genesis of this complex mineralization is interpreted as a single episode of synvolcanic hydrothermal mineralization, with subsequent local remobilization during regional deformation.

The Rexspar deposits have a regional geologic setting, local lithologic association, interpreted volcanic setting, and exotic mineralogy, and a metal content similar to those of the type Olympic Dam deposits of south-central Australia. The strong possibility that Rexspar represents a Paleozoic analogue of Olympic Dam-type mineralization argues for a re-evaluation of the property and other nearby showings. The Birch Island district merits renewed mapping based on an awareness of the regional geologic setting and structural, lithologic and volcanic controls on localization of Precambrian deposits. The potential for additional sites of similar mineralization within the widespread Eagle Bay Formation should be investigated with regional geochemical surveys. If the Birch Island deposits and showings are verified as younger analogues of Olympic Dam-type deposits, other deposits included within global classifications of Volcanogenic or Volcanic-hosted Uranium deposits (Cox and Singer, 1986; Goodell and Waters, 1981) warrant reassessment using the exploration criteria developed from studies of Olympic Dam-type deposits.

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Alteration Atlas
Call for Contributions

Introduction

Photographic atlases provide an effective means of displaying textural and mineralogical features in rocks. Those that have been produced in book or poster format have been devoted to fresh rocks, classic textures (volcanic, sedimentary, breccia, *etc.*) beautiful examples of major rock forming minerals, or specialist topics (quartz vein textures). Most rocks are altered, however, and alteration is an important criteria for mineral exploration, evaluation of geothermal systems, and the interpretation of depositional and post-depositional environments. Alteration mineralogy and related problems are rarely taught at the undergraduate level, particularly in terms of field recognition, and learning to understand its significance requires years of practice. This is a major gap. A photographic atlas will fill part of this gap by providing a visual reference for use in education and employment.

Format

The atlas will provide an introduction to all major types of alteration, organized with reference to the environment of formation and proximity to ore deposits. Major alteration types may require two or three examples to illustrate variations due to different host rocks. Approximately 30 important alteration types will be covered with a total of 50 photographic examples. Each example will be covered by two pages; a page of text describing the alteration, mineralogy, environment of formation, relationship to other styles of alteration, and further references; and a page of photographs - two to four covering outcrops, hand specimens, and photomicrographs. As presently envisaged, the atlas will be published under the auspices of the Mineral Deposits Division of the Geological Association of Canada as a soft cover, 8.5x11 manual, although field note book cards and a wall poster could be future additions.

Contributions

Contributions are requested. Authors may submit as many as they wish and solicit others from colleagues. Contributors will have to provide a page of text and a minimum of two, high-quality colour photographs. The examples to be used in the atlas will be chosen by an editorial review panel and authorship will be attached accordingly. The final date for submission is December 31, 1993. If you intend to contribute and/or would like full details on the format and requirements, please return the form below before June 30, 1993.

ALTERATION ATLAS

I will submit example(s) of alteration: yes | no   I wish to receive further information on submissions: yes | no

Name: Address: Telephone:

Return to: John F.H. Thompson; MDRU, Dept. of Geol. Sciences; Univ. of British Columbia; 6339 Stores Road; Vancouver, B.C., V6T 1Z4, FAX 604-822-6088