Project 750051: Uranium Reconnaissance Program

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Introduction

An examination of some uranium occurrences in Washington and south-central Idaho was undertaken in early August, 1976. Three types of geological environments were chosen for study, based on their similarity to the British Columbia environments encountered during the Federal-Provincial Uranium Reconnaissance Program surveys in south-central British Columbia.

The geochemical survey in British Columbia undertaken under this program during the 1976 field season covered 82 E, L and M, 1:250 000 map-sheets (Fig. 48.1), and was done by a contract crew under the supervision of S. B. Ballantyne. An attempt to sample this 46 800 km^2 area at a mean density of one sample per 13 km^2 necessitated the use of ground sampling teams in four-wheel drive vehicles, teams in boats on the large lake systems, and a team in helicopter-supported sampling operations. Samples of stream waters and stream sediments were collected; the water samples being analyzed immediately for uranium, fluorine and pH. Sediment samples were dried and sent to Ottawa for preparation and analysis. Results for the water analysis have shown anomalous results in uranium and fluorine near known uranium mineralization, plus numerous heretofore unknown situations.

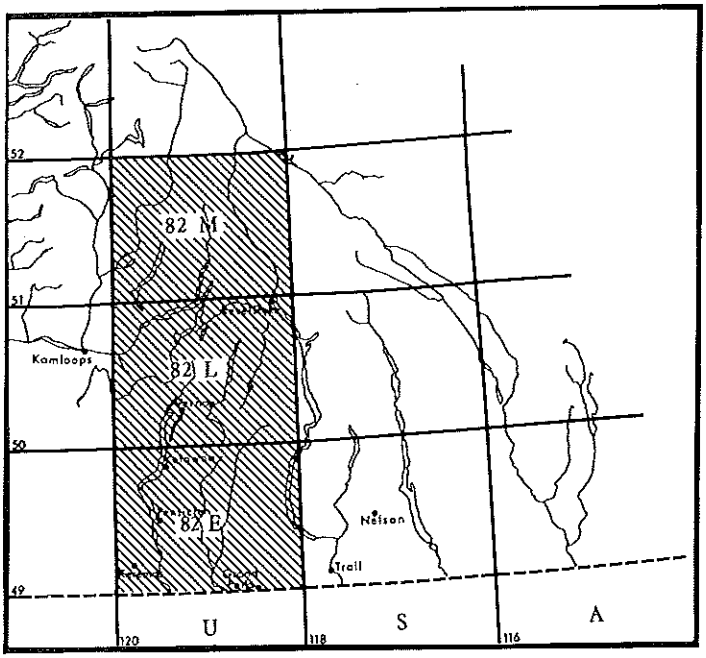

Figure 48.1. British Columbia Uranium Geochemical Reconnaissance Program, 1976.

Midnite Mine, Washington

The Midnite uranium mine, owned by the Dawn Mining Co., is on the south flank of Spokane Mountain, about 65 km northwest of Spokane. The mine office and concentrator is in Ford, Washington. Mineralization at the Midnite mine occurs primarily in a Precambrian roof pendant of argillites, phyllites, quartzites and dolomites which lies within a Cretaceous granitic intrusive.

An area of known uranium mineralization in Custer County, Idaho was chosen for study because of a number of similarities to the Fuki-Donen and Tyee Lake Resources uranium occurrences in south-central British Columbia. Bedded sedimentary deposits at the base of a volcanic series as well as vein deposits in batholithic rocks occur within the same drainage basin. The Idaho mineralization has been well documented (Kern, 1959; Choate, 1962) and a number of showings have been exposed by localized stripping and surface mining. A geochemical orientation survey, completed by the U.S. Atomic Energy Commission (Illsley, 1961), indicated that the sampling of stream waters was a successful method for detecting uranium mineralization in mountainous topography. This earlier study provided a useful comparison to the refined analytical methods used in the present British Columbia program and aided the interpretation of the 1975 orientation survey near the Fuki-Donen prospect area (Ballantyne and Bottriell, 1975).

Intrusive rocks, within which the roof pendant lies, consist of a coarsely crystalline porphyritic quartz monzonite containing large potassium feldspar phenocrysts. Locally, the intrusive has been intensely weathered, leaving grains of quartz and feldspar crystal remnants at surface. The contact between the intrusive and the roof pendant is undulatory, creating numerous pendant-filled hollows which may have been channels for uranium-bearing solutions. The major uranium host has been pelitic rocks which have been metamorphosed to phyllite, schist and hornfels. Calc-silicate hornfels and amphibolite are also hosts. Uranium occurs as pitchblende and coffinite in shears and as disseminations along foliation (Nash, 1975). In the oxidized zones uranium occurs primarily as meta-autinite, both at the base of the intrusives and the upper portions of the metasediments.

The majority of the economic concentrations occur in depressions in the intrusive (Fig. 48.2). Mineralization is usually tabular and crosses lithologic boundaries. The most likely mode of origin of the deposits is the migration of uranium-bearing groundwaters through permeable sections of pyrite-rich metasediments (Sheldon, 1959; Nash, 1975).

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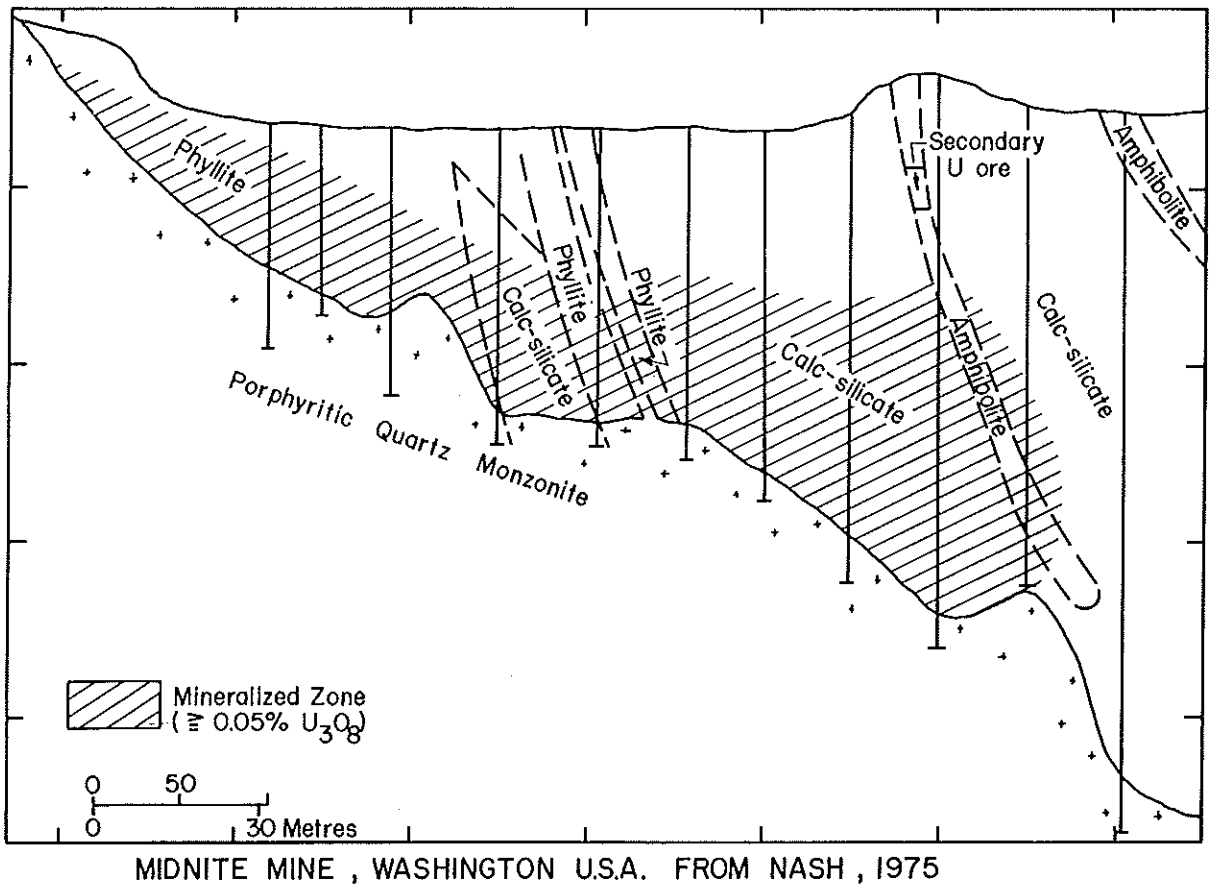

Figure 48.2. Cross section through an ore zone. Mineralization crosses lithologic boundaries and occupies depressions in the monzonite.

Other uranium deposits are known in the area, the most promising being the Sherwood Prospect about 8 km south of the Midnite Mine. The Sherwood Prospect lies in an unconsolidated sedimentary horizon within a Tertiary volcanic series and is estimated to contain 15 million pounds of U_3O_8 (Mr. E. Craig, pers. comm.).

Idaho Deposits

The uranium deposits studied lie in Township 11N, Ranges 13 and 14E, Boise Principal Meridian, Custer County, Idaho (lat. 44°17', long. 114°50'). Access to the area is by U.S. Highway 93, a paved road leading from Stanley to Sunbeam, about 125 km northeast of Boise. Most of the mineral occurrences have access to roads which are passable to 4 wheel-drive vehicles.

The Stanley uranium area lies in the Salmon River mountain belt, with elevations ranging from 1800 to 2660 m. The hills have steep sides but exhibit rounded tops. North-facing slopes support conifers while south-facing slopes have a cover of sage brush and isolated trees. Precipitation is about 40 cm annually, falling mostly as winter snow. In general, the area is similar in appearance to the Kamloops and Okanogan regions of British Columbia.

Two rock units predominate (Fig. 48.3). The most widespread comprises intrusive rocks belonging to the Idaho Batholith of Cretaceous age (Choate, 1962). The composition and texture of these intrusive rocks are not uniform throughout but grade from quartz monzonite to granodiorite and from coarse grained porphyritic near the contact to fine- to medium-grained granitic near the western boundary. In the immediate area of the uranium deposits the intrusive is notably porphyritic with phenocrysts of microcline predominating. The intrusive is heavily fractured and deeply weathered. The Nelson batholithic rocks near Beaverdell, British Columbia show similar features.

The intrusive is unconformably overlain by the Challis volcanic series. Paleontological evidence indicates an Oligocene age (Ross, 1962) which is similar to the Kamloops Group of south-central British Columbia (Jones, 1959). The volcanics grade from andesite to rhyolite in composition; thick sequences of porphyritic tuff have been exposed and overlie a number of uranium occurrences.

The basal portion of the Challis series is an irregular band of sedimentary rocks derived by erosion from the batholith prior to volcanism. The lowest portion of this sedimentary sequence consists of arkosic sandstone, arkose, and conglomerate, all of which are

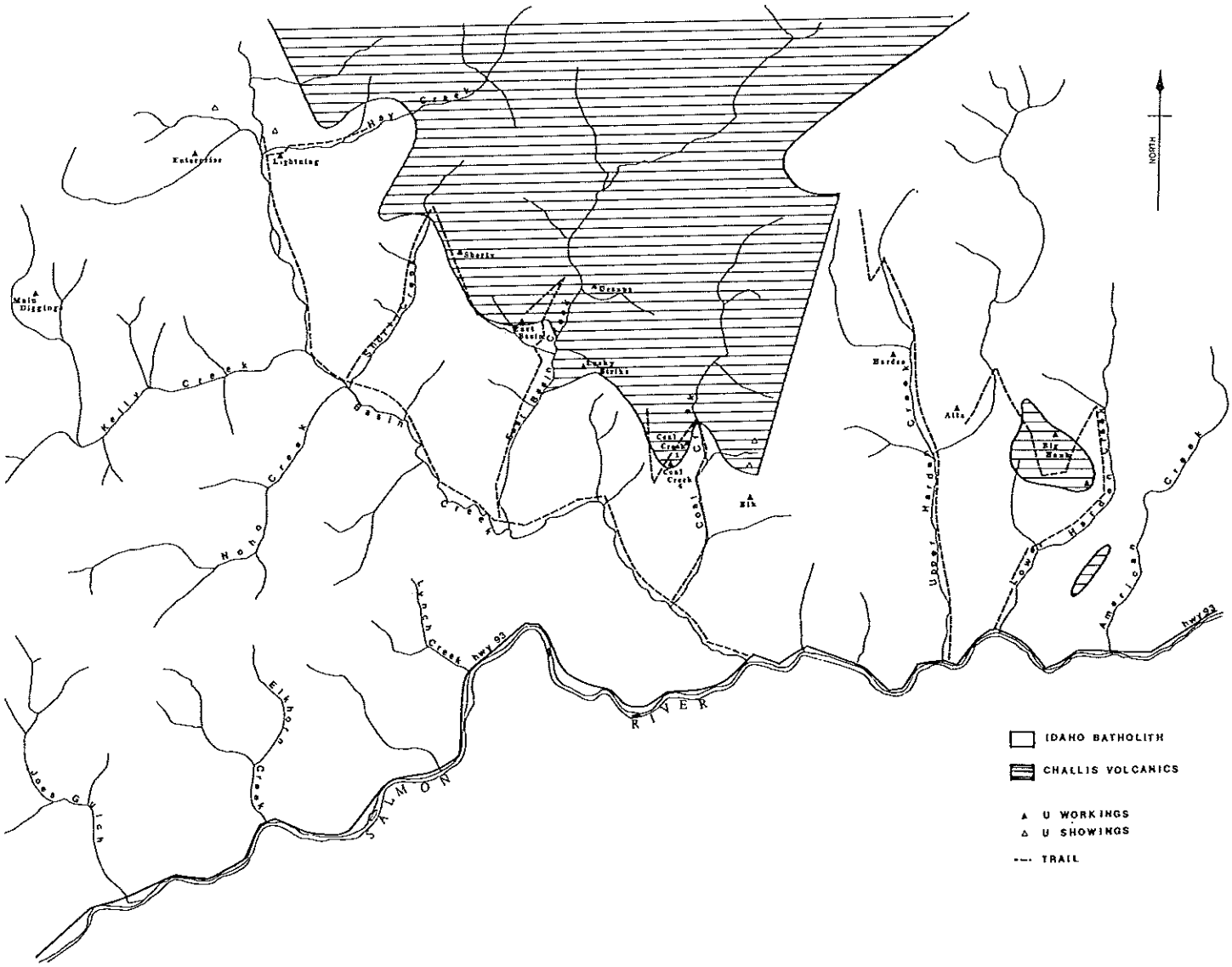

Figure 48.3. Distribution of Idaho Batholith and Challis Volcanic rocks in Stanley area, Idaho.

highly carbonaceous. In places the sediments are less than one metre thick but elsewhere more than 30 m have been measured. The carbon-rich sedimentary rocks at the base of this sequence are the main hosts for uranium mineralization in the Stanley area.

Vein Type Uranium - Lightning Occurrence

Mineralization consists of sooty pitchblende stringers within a vein-filled fault zone in the batholith at the Lightning occurrence on Hay Creek. These stringers range in thickness from less than 1 to more than 20 mm and often occur with chalcedony. Fluorite is known in the area and stibnite, molybdenum, pyrite and gold have been observed near the uranium mineralization (Kern, 1959). In the rock-suite collected near the surface at the Lightning occurrence, secondary uranium minerals tentatively identified as uranophane and autinite were noted on fracture surfaces. Up to 1960, a total of 691 tons of ore grading 0.17 per cent U_3O_8 was shipped from the Lightning zone.

Sedimentary Type Uranium - Coal Creek Occurrence

The Coal Creek No. 1 pit on the west bank of Coal Creek is a well exposed example of the sedimentary type of uranium occurrence referred to previously. Mineralization occurs in the matrix of a poorly consolidated cobble conglomerate which fills an ancient stream channel. The channel, cut in quartz monzonite, parallels a fracture set and probably followed pre-existing fractures in the intrusive. Ore-grade mineralization occurs over 2 m above the quartz monzonite, with the highest grade ore occurring in a greyish black layer 20 to 40 cm thick at the base of the main channel. Carbonaceous material was observed

throughout the conglomerate matrix; a 3-cm stringer of highly radioactive lignite coal occurred at the channel base at one locality. Autinite staining on surface boulders and within the surface layers of the quartz monzonite suggests that the remobilization of uranium minerals is occurring at present. This type of occurrence strongly resembles the Fuki-Donen type of sedimentary uranium mineralization presently under investigation near Beaverdell, British Columbia.

Exploration Geochemistry

Previous work in the Cordillera suggested that sampling of stream waters may be a valid exploration technique in the search for uranium (Illsley, 1961; Nash, 1975). In addition to the analysis for uranium, fluorine may act as a useful pathfinder. Background values for uranium in stream waters typically are below 0.1 ppb. Values of 1.0 ppb may indicate proximity to mineralization and values exceeding 10 ppb are not uncommon near mineralization of the Fuki-Donen type. It must be stressed however, that high values of uranium in stream waters may not be directly indicative of weathering mineralization. Values approaching 10 ppb have been obtained in the United States and in central British Columbia from creeks draining deeply weathered potassium-rich porphyritic intrusive rocks which contain no known ore-grade uranium mineralization. The geological environment within each anomalous drainage basin must be studied closely when placing priorities on geochemical anomalies.

Basin areas which the Kamloops volcanic series has infilled, such as those around Hydraulic Lakes and their more northerly occurrences should be examined. Areas of Cretaceous and more recent intrusives which exhibit distinct surface weathering should be studied closely to ascertain groundwater movement and direction. Structures associated with these intrusives may yield responses.

Other basin areas in the Okanogan may yield anomalous uranium results. The stratigraphy of these small basins should be mapped and thicknesses of sediments correlated. Some areas in the southern part of the area surveyed contain pegmatite veins which have yielded uranium responses. The extent of these vein systems is unknown.

Dispersion of uranium in water from known mineralization of the Fuki-Donen type can be up to 8 km, providing the dilution of the major drainage by background creeks is not excessive. Sampling of secondary drainages where stream length is less than 3 km from a suspected target will increase anomaly contrast and definition.

Examination of the Midnite Mine, the Stanley Basin mineralization and the Fuki-Donen area has shown a number of similarities. A porphyritic, potassium-rich intrusive of probable Cretaceous age lies near all deposits. The intrusive is characteristically deeply weathered leaving a surface rubble of quartz grains and feldspar phenocrysts. An aquifer unconformably overlying the intrusive and in turn overlain by a competent cap rock occurs at each site. Within each aquifer a means for precipitating uranium from solution has been noted, either carbonaceous material or an abundance of iron-bearing minerals. The collection basins for ore-grade mineralization in each of the deposits is areally small, usually between 0.8 and 0.4 km in length, and about 100 m wide.

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