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# Alteration and Element Distribution Associated with Selected Uranium Deposits of the Great Divide Basin, Sweetwater County, Wyoming

by

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# ABSTRACT

The stratigraphic setting, alteration features and distribution of selected elements were studied in the REB uranium deposit, Sweetwater County, Wyoming. The purpose of the study was to determine ore guides that might be used in further exploration in the area.

The REB deposit occurs in the REB interval of the Lower Eocene Battle Spring Formation, an alluvial-fan complex deposited to the south of the uplifted Granite Mountains. The REB interval in the study area consists of interbedded coarse arkosic sandstones and carbonaceous siltstones. The unit is approximately 140 ft (50 m) thick, and is situated between two anomalously radioactive, carbonaceous mudstones of the Wasatch Formation.

Results of this study suggest that a stratigraphic control on uranium deposition in the REB interval does exist. The linear and continuous nature of the mineralization trend, the relationship of the terminus of the roll front to an increase in the number of fine-grained units, and the location of the deposit near and subparallel to the transition from coarse-grained rocks of the Battle Spring Formation to finer grained rocks of the Wasatch Formation all support the conjecture that uranium deposition may be related to that transition. The orientation of

sandstone bodies deposited in southwest-trending Eocene paleostream channels does not appear to be related to the trend of the deposit.

Samples of drill core were classified as altered, slightly altered or fresh on the basis of the presence of iron oxides, pyrite and colored feldspar grains. Pyrite and calcite are associated with mineralized rock. Altered orange feldspars are found exclusively in mineralized rock; altered pink feldspars are found in slightly altered rock ahead of the roll fronts. Coloration of these feldspars is pervasive and is due to disseminated hematite-limonite within the feldspar grains. These grains have not been altered to other minerals.

Analyses for silver, calcium, copper, iron, lithium, magnesium, manganese, molybdenum, sodium, selenium, thorium, vanadium and uranium were carried out. Silver, calcium, iron, lithium, magnesium, manganese, and rubidium have been leached from altered rocks. Element zoning, as delineated in this study, might be used to distinguish altered from fresh rock on a statistical basis.

Results of this study show that visual classification of samples as altered, slightly altered or fresh is a valuable and fairly accurate tool for locating mineralization. The best ore guide in the REB deposit is

the presence of colored feldspar grains. Gamma logs are also useful in locating ore because radiometric equilibrium has been, for the most part, reached and maintained within the REB deposit. The presence of colored feldspars can be used as an immediate and reliable indicator of mineralization in the REB deposit, prior to gamma logging of drill holes. The effectiveness and simplicity of visual techniques make careful inspection of samples more cost-effective than chemical analysis.

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# INTRODUCTION

## Purpose

The purpose of this study was to examine the alteration and the distribution of selected elements associated with roll-front uranium deposits in the study area. Objectives were to establish the stratigraphic setting of the deposits, to determine the types of alteration that occur within the study area and to study the distribution of alteration features and of trace elements. The study was aimed at finding controls on mineralization, alteration features or element distribution patterns that might be used in further exploration and development in or near the study area.

## Scope of Work

The study area is located in the Great Divide Basin of Wyoming, a part of the greater Green River Basin (fig. 1). The Eocene Battle Spring Formation is the host for roll-front uranium mineralization within the study area.

This study was undertaken beginning in the summer of 1980, when the author was employed by Minerals Exploration Company, a subsidiary of Union Oil Company of California. The Battle Spring Formation is poorly exposed and heavily

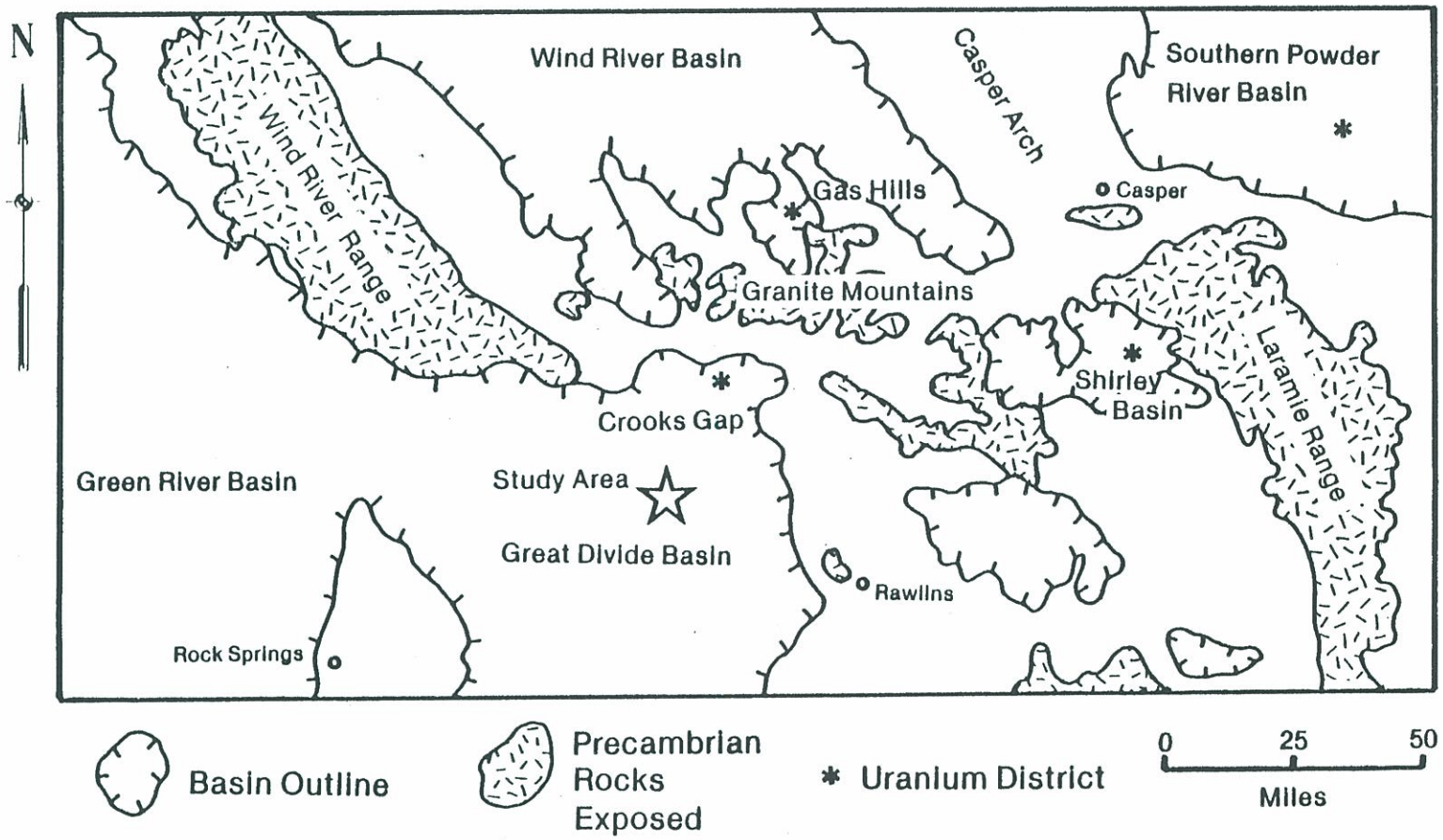


Figure 1. Simplified tectonic map of south central Wyoming, showing outlines of Tertiary basins, Precambrian exposures, and uranium districts (modified after Childers, 1970).

weathered at the surface, so subsurface sampling was chosen to give more consistent geochemical results. Drill holes were selected to give the widest possible coverage of the study area. Geophysical and lithologic logs from eight cored drill holes and 57 rotary drill holes were used in this study. Lithologic and electric logs were acquired and are published herein with the consent of Union Oil Company of California. The author has logged numerous drill holes within the study area, but not necessarily the specific holes that are used.

One hundred seventy-nine samples were taken at one-foot intervals from the eight cored drill holes. These were examined using a binocular microscope; eleven samples were examined in thin section. Three pan concentrates were examined for heavy mineral content. Petrographic descriptions are presented in Appendix III. Samples were sieved to obtain quantitative size-fraction data. X-ray diffraction was used to analyze clay-size material from a suite of 17 samples.

Samples were analyzed by flame atomic absorption methods for Ag, Ca, Cu, Fe, Li, Mg, Mn, Na, and Rb. Delayed neutron activation was used to analyze for U. Samples from one core were analyzed for Mo, Se, Th and V. Analytical methods are discussed in Appendix I. Accuracy and precision

of analyses are presented in Appendix II. Statistical treatment of the data is discussed later in this paper.

## Location and Geography

The study area is located within the Great Divide Basin, about 40 mi (60 km) northwest of Rawlins in northern Sweetwater County, Wyoming (fig. 2). The area is covered by the Rawlins 1x2-degree Quadrangle of the National Topographic Map Series (NTMS). Principal towns in the area are Rawlins to the southeast, Rock Springs to the southwest and Jeffrey City to the north (fig. 2). The study area comprises contiguous portions of Townships 23 and 24 North in Range 94 West, Sixth Principal Meridian.

Access to the area from Interstate 80 is provided by the unpaved Crooks Gap Road north from Wamsutter, Wyoming, located approximately 60 mi (100 km) east of Rock Springs, Wyoming. An alternate route is via U.S. Highway 287 north from Rawlins approximately 15 mi (25 km) to a paved mine road leading west (fig. 2).

The Great Divide Basin is both a structural and topographic feature. It is bounded on the north by the Granite Mountains and Wind River Range, on the east by the Rawlins Uplift, on the south by the Wamsutter Arch and on the west by the Rock Springs Uplift (fig. 2). The basin is

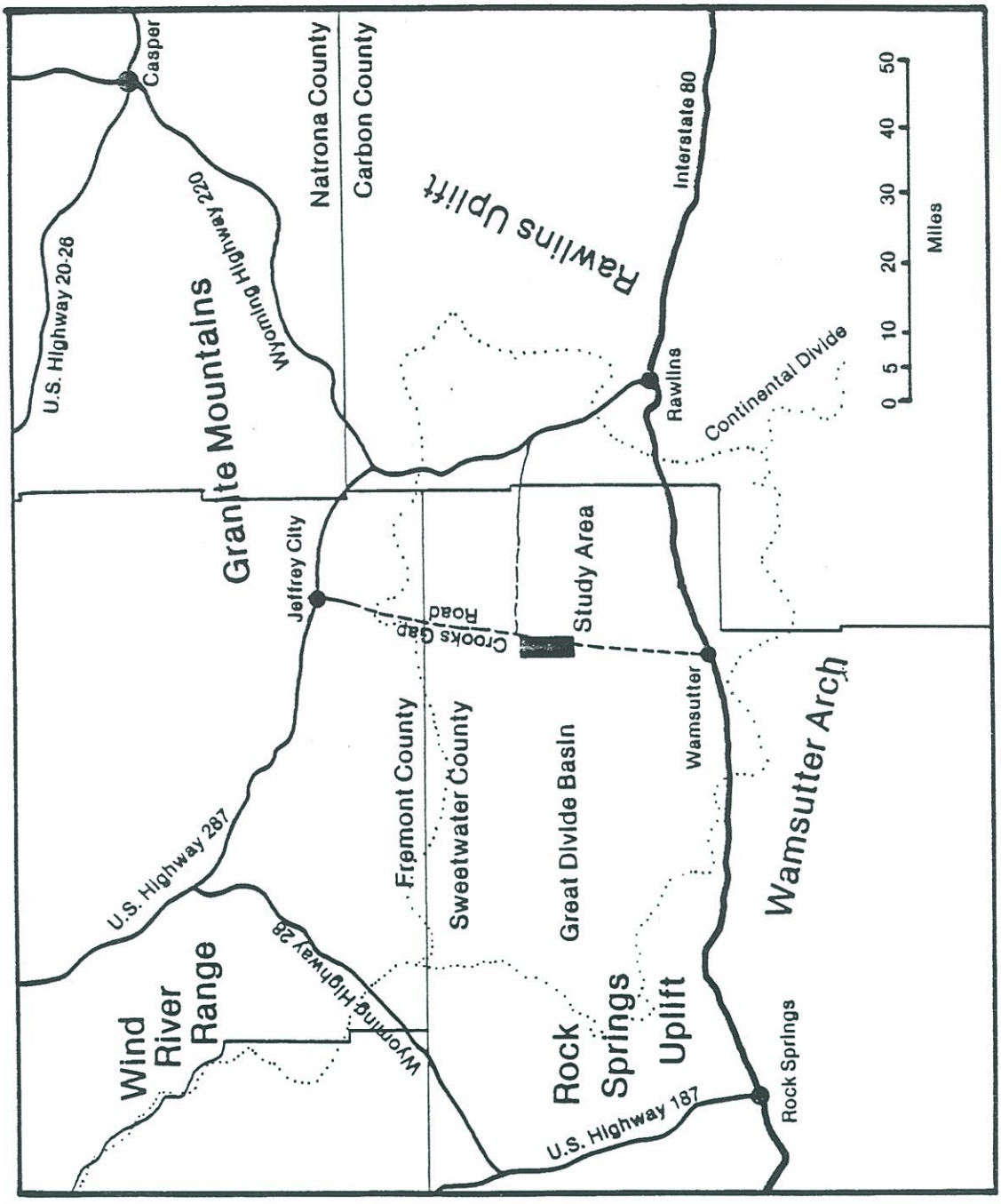


Figure 2. Location map (modified after Wayland and Sayala, 1983).

located between two branches of the Continental Divide and its drainage is entirely internal. The topography in the study area is essentially flat, with low bluffs at the extreme south. The average elevation is 6500 ft (2000 m). The flora and fauna are typical of the high plains of the western United States with the notable exception of a small herd of wild horses.

## PREVIOUS INVESTIGATIONS

Uranium was discovered in the Great Divide Basin by the late Mrs. Minnie McCormick in about 1935 (Wyant, Sharp and Sheridan, 1956). Uranium-bearing coal was discovered in the basin by Slaughter in 1945 and was first described by Wyant, Sharp and Sheridan (1956). Sheridan and others (1961) described the Lost Creek schroeckingerite deposits, which are located about 5 mi (3 km) west of the study area. Pipiringos (1961) and Masursky (1962) described the stratigraphy and geology of the basin with emphasis on the uranium-bearing coals. Stephens (1964) described the lithology of the Wasatch and Battle Spring Formations in his study of uranium deposits in the Crooks Gap area. Bailey (1969, 1972) discussed the uranium deposits of the Great Divide Basin.

Love (1970) compiled the Cenozoic history of the Granite Mountains area of central Wyoming, including parts of the Great Divide basin. Pipiringos and Denson (1970) discussed the Battle Spring Formation of south-central Wyoming. In 1970, Groth described roll-front uranium deposits in the Battle Spring Formation in the Green Mountain area, about 15 mi (25 km) east of the study area. He briefly described the alteration associated with the deposits as similar to that in other Wyoming uranium

districts. Files (1970) investigated the geology and alteration associated with Wyoming uranium deposits for a Ph.D. dissertation. In an unpublished thesis, Cisneros (1970) described a uranium anomaly at the Silver Bell prospect, just to the north of the study area.

Childers (1974) reported on the Upper Cretaceous and Tertiary strata of Wyoming and northern Colorado with reference to uranium deposits in these rocks. DeNault (1974) carried out research in the Great Divide Basin and elsewhere for a Ph.D. dissertation on the origin of sandstone-hosted uranium deposits in Wyoming. Boberg (1979) and Sherborne and others (1980) discussed the origin and stratigraphic controls on uranium mineralization.

The source of the uranium in Wyoming roll-front uranium deposits has been addressed by Waters and Granger (1953), Houston (1969), Rosholt and Bartel (1969), and Rosholt, Zartman and Nkomo (1973), and Stuckless (1979), as well as many others. Stuckless (1977) summarized uranium-related studies of the Precambrian rocks of the Granite Mountains of Wyoming. Love (1970) and others believe Oligocene tuffaceous beds to have been the source of at least part of the uranium. Current work on the Great Divide Basin uranium deposits includes the multidisciplinary studies carried out by Bendix Field Engineering Corporation in the immediate

vicinity of the study area (Wayland and Rood, 1983; Wayland and Sayala, 1983).