URANIUM AND HYDROCARBON EXPLORATION TARGET AREAS SUGGESTED BY EOCENE STREAM PATTERNS IN THE WIND RIVER BASIN, WYOMING

David A. Seeland

U. S. Geological Survey, Federal Center, Denver, Colorado 80225

Paleocurrent maps of the fluvial Early Eocene Wind River Formation in the Wind River Basin of central Wyoming define promising uranium and hydrocarbon exploration targets. Uranium deposits are more likely to be in the Wind River Formation where it contains channel sandstones derived from the Granite Mountains. These areas include: (1) the 40-kilometre segment along the Eocene Wind River west of Powder River, Wyoming, (2) the area between this segment of the Eocene Wind River and the Granite Mountains, excluding the Gas Hills uranium district, and including the entire southeastern part of the basin southeast of Powder River.

Areas where channel sandstones of the Eocene Wind River overlie natural gas fields may be particularly favorable places to search for uranium because leaks of sulfur-containing gas may have created a reducing chemical environment in the sandstones. Also, the sandstones are themselves potential hydrocarbon reservoirs, particularly where they overlie the organic-rich Waltman Shale Member of the Fort Union Formation.

Crossbedding orientation measurements in the Wind River Formation were used to construct vector mean and moving average maps which define the paleocurrent systems and source areas of the early Eocene rocks of the basin. During the Eocene the Wind River flowed east-southeast across the northern part of the basin, left the basin near Powder River, Wyoming, and flowed eastward across the Casper Arch into the Powder River Basin. Northeasterly flowing streams carried coarse-grained arkosic sands in which the Shirley Basin and Gas Hills uranium deposits formed.

SULFUR ISOTOPES AND SULFIDE DEPOSITION IN THE RED SEA GEOTHERMAL SYSTEM

W. C. Shanks

Department of Geological Sciences, University of Southern California, Los Angeles, California 90007

and J. L. Bischoff

U. S. Geological Survey, Menlo Park, California 94025

The Red Sea geothermal deposits provide a unique opportunity to study a modern ore deposit in the process of formation. Of particular interest is the sulfide facies which is analogous to many ancient massive sulfides in ore potential, bulk composition and sulfur isotope composition.

Detailed sulfur isotope analysis of 10 piston cores from the Atlantis II Deep reveals a complex and discontinuous history of sulfide precipitation. Sulfur isotope ratios (δS^{34}) within the sulfide facies vary from −45 to +15‰. Values ranging from −45 to −20‰ are ascribed to bacteriogenic processes when brine activity is minimal. Hydrothermal sulfides have δS^{34} values from 0 to +15‰ and are directly related to hot brine activity. δS^{34} variations within hydrothermal sulfide zones are due to fluctuating physico-chemical conditions within the brine pool and, in some cases, admixture of biogenic sulfides.

In addition, samples from 10 brine-filled deeps outside the Atlantis II area were analyzed. Most of these deeps contained typical marine sulfides. Three of these deeps, however: Thetis, Shagara, and Suakin, contained hydrothermal sulfides similar to the Atlantis II Deep sulfides facies.

The most likely process of sulfide formation is moderately high temperature reduction of sea water sulfate in contact with recent shallow intrusives in the axial rift zone.

LIMITS ON THE DURATION OF HYDROTHERMAL ACTIVITY AT STEAMBOAT SPRINGS, NEVADA, BY K-AR AGES OF SPATIALLY ASSOCIATED ALTERED AND UNALTERED VOLCANIC ROCKS

Miles L. Silberman and Donald E. White

U. S. Geological Survey, Menlo Park, California 94025

Steamboat Springs is a present-day active equivalent of epithermal Au-Ag ore-forming hydrothermal systems. Steamboat's sinter deposits contain small amounts of Au, Ag, Hg, Sb, and As. Geologic mapping by White and others (1964) has demonstrated that hot-spring activity started before extrusion of the basaltic andesite of Steamboat Hills. Sinter from the Steamboat system occurs in gravels that are overlain by the basaltic andesite. Intense hydrothermal alteration, including almost complete replacement by hydrothermal K-feldspar, has affected the basaltic andesite. Three plagioclase separates of differing potassium content from fresh basaltic andesite yielded K-Ar ages of 2.52–2.55 m.y. A sample of basaltic andesite replaced by K-feldspar gave an age of 1 m.y.

The thermal area lies approximately on a line connecting four rhyolite domes. The largest of these is nearest to the springs and lies 3 km to the southwest. The domes occupy vents from which pyroclastic material of both pre- and post-basaltic andesite age was erupted. Pumice blocks up to 5 cm diameter occur in gravels that underlie and overlie the basaltic andesite. The source of energy for the thermal convective system is most probably the rhyolitic magma chamber that supplied the pumice and from which the rhyolite domes were emplaced. Sanidine and obsidian from four of the rhyolite domes gave K-Ar ages of 1.15–1.52 m.y.

The data indicate that hydrothermal activity has occurred at Steamboat Springs, possibly intermittently for more than 2½ m.y. The data agree with K-Ar age studies indicating 1- to 2-m.y. lifetimes for the hydrothermal systems that generate epithermal Au-Ag deposits.