U.S. Geological Survey Fact Sheet

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Geochemical Studies in the Coconino National Forest, Arizona

In cooperation with the U.S. Forest Service, the U.S. Geological Survey is conducting a multidisciplinary study of the Coconino National Forest, northern Arizona, an area of approximately 2 million square miles (814,000 hectares) (figs. 1 and 2). The study includes geologic mapping and geochemical and geophysical surveys to determine (1) the mineral resource potential in the forest, and (2) any potential environmental hazards that may be present there. The purpose of this study is to provide unbiased information to Federal and State land management agencies and to the general public that will address important questions regarding:

- Land-use decisions,
- Mineral and energy resources,
- Naturally occurring metal contamination,
- Chemical baseline (normally expected) concentration levels,
- Abnormally high metal concentrations caused by human activities,
- Remediating abandoned mine sites.

Figure 1. Location of Coconino National Forest, Arizona

To address the geochemical part of the assessment, the U.S. Geological Survey has analyzed samples of rock, mine-dump material, and sediment from active stream channels from sites throughout the forest. Chemical analyses of these samples were evaluated by plotting their values on a geologic base map to identify those localities where unusually high concentrations may be present for elements such as antimony, arsenic, cadmium, copper, gold, iron, lead, manganese, silver, uranium, and zinc.

Within the forest, past mining or mineral exploration centered on deposits of manganese in the general vicinity of Area A (fig. 2) and uranium in the vicinity of Area B, (fig. 2). In addition to sampling in these two previously explored areas to characterize their chemistry, we collected samples in an area of relatively undisturbed volcanic rocks near Verde Hot Springs on the Verde River (Area C, Fig. 2). The physical appearance of this area is similar to other localities with volcanic rocks that contain known mineral deposits. Samples from Area C were found to contain elevated concentrations of antimony, arsenic, barium, manganese, molybdenum, and(or) zinc, suggesting that undiscovered mineral resources for deposits containing one or more of these elements could be present in this unmined area. At the reconnaissance scale of the geochemical sampling done for this study, we could not accurately define the extent of unusual metal concentrations.

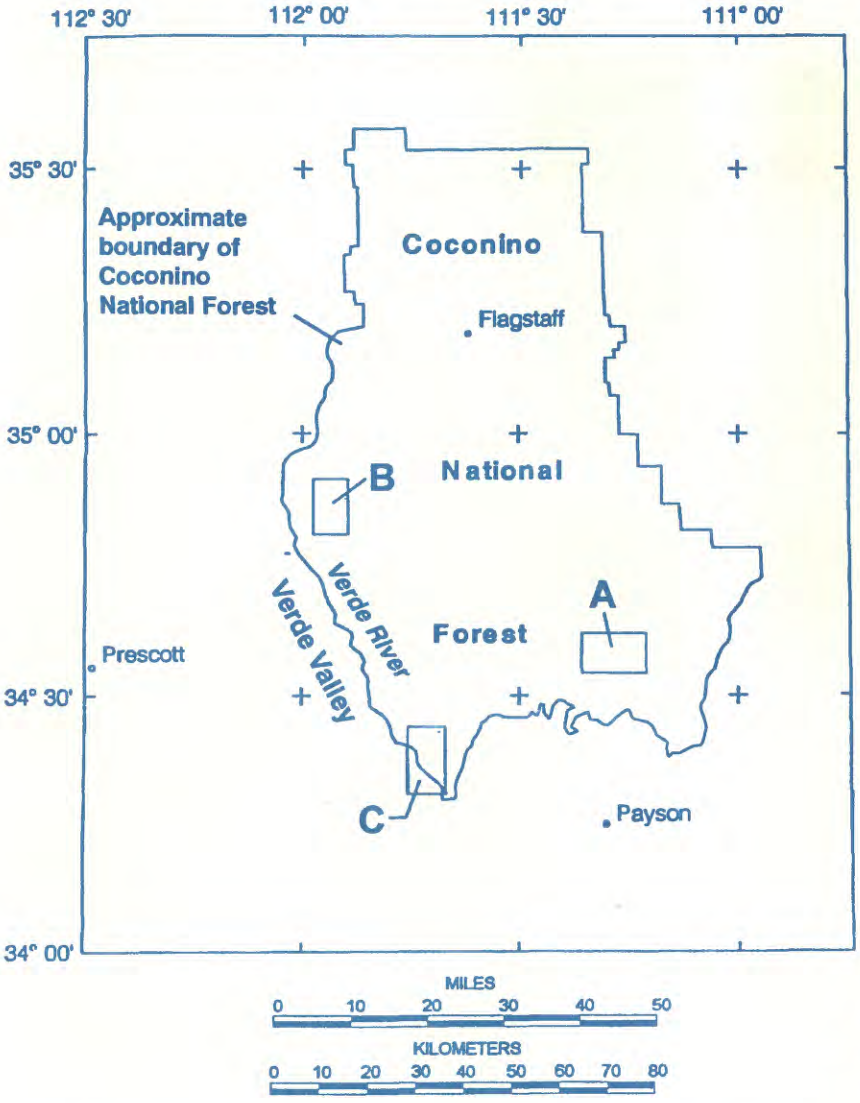

Figure 2. Coconino National Forest, showing study areas described in text

From an environmental standpoint, the analyses of mine-dump samples and of stream-sediment samples collected downstream from abandoned manganese mines or prospects show that the manganese minerals are enriched in metals such as antimony, arsenic, cadmium, copper, molybdenum, silver, and zinc. The exact areal extent of contamination from these mining activities is not known, but relatively weakly elevated concentrations of arsenic, cadmium, lead, molybdenum, and silver were found in stream-sediment samples collected as far as 2.8 miles (4.5 km) downstream from the abandoned Last Chance mine (in Area A), the largest manganese mine in the forest. The total downstream distance of transport of this mine dump material is not known. However, the enriched but relatively low levels of these elements probably do not present an environmental problem.

Many of the identified uranium occurrences in Coconino National Forest are found in lakebed sediments in or near the Verde Valley area (fig. 2). Some areas of this valley are relatively densely settled; however, such areas are not within the forest. Uranium concentrations as high as 14 parts per million (ppm) have been detected in stream-sediment samples analyzed for this study. Investigations by Duncan and Spencer (1993, p. 96) indicate that concentrations above 6 ppm uranium are anomalous. Samples collected for this study that have anomalous concentrations of uranium are from localities both in the Verde Valley and elsewhere in the forest.

Radon, a potentially hazardous gas that is a product of the chemical breakdown of uranium, was not measured for this study but is known to be present in the vicinity of uranium occurrences in the Verde Valley. Measurements of radon gas in 40 homes in that area (Duncan and Spencer, 1993, p. 51-56) revealed indoor radon levels in four homes above the maximum level of 4 picocuries per liter recommended by the Environmental Protection Agency. This USGS study will therefore help to define the areas where high levels of uranium may be present in the Coconino National Forest and thus where potentially hazardous radon concentrations may exist.

Reference Cited

Duncan, J.T., and Spencer, J.E., 1993, Uranium-bearing rocks in Verde Valley, Yavapai County, and implications for indoor-radon gas, *in* Spencer, J.E., ed., Radon in Arizona: Arizona Geological Survey Bulletin 199, 96 p., 2 plates. ❑

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