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Mineral Resource Potential of the Southeast Addition to the White Mountain Wilderness, Lincoln County, New Mexico

by

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the southeast addition to White Mountain Wilderness, Lincoln County, New Mexico. The area was established as a wilderness by Public Law 96-550 on December 19, 1980.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

A geologic and geochemical investigation and a survey of existing mines and prospects of the southeast addition to the White Mountain Wilderness indicates only minor mineral occurrences. In contrast, previous studies of other parts of the wilderness reported numerous mineral occurrences. Although other parts of the White Mountain Wilderness have produced base and precious metals, prospects in the southeast addition have yielded no ore, and geochemical data indicate low potential for both base and precious metals. Low-grade molybdenum ore has been reported a few miles to the northwest, but the molybdenum potential within the southeast addition was found to be low. The resource potential for oil and gas is also low, and there is no evidence of geothermal activity.

INTRODUCTION

In 1979 and 1980, the U.S. Geological Survey and the U.S. Bureau of Mines conducted an investigation of the mineral resource potential of the southeast addition to the White Mountain Wilderness, Lincoln County, N. Mex.

During the period 1973-1980, studies were made of several areas totaling 16,860 acres that were proposed as additions to the wilderness. These studies ultimately resulted in the establishment of new boundaries for the wilderness with the passage of Public Law 96-550 on December 19, 1980 (fig. 1). Most of the proposed additions were described by Segerstrom and others (1979). This report covers an addition to the wilderness, referred to as the "study area" or the "addition," of approximately 7 mi^2 not included in Segerstrom and others (1979). The addition is in T. 10 S., R. 11, 12, 13 E. in the southeastern part of the wilderness. This addition is bounded on the north by the Rio Bonito, on the east by State Highway 37, and on the south by Little Creek. The southeast corner of the area is about 1 mi north of the town of Alto (fig. 1).

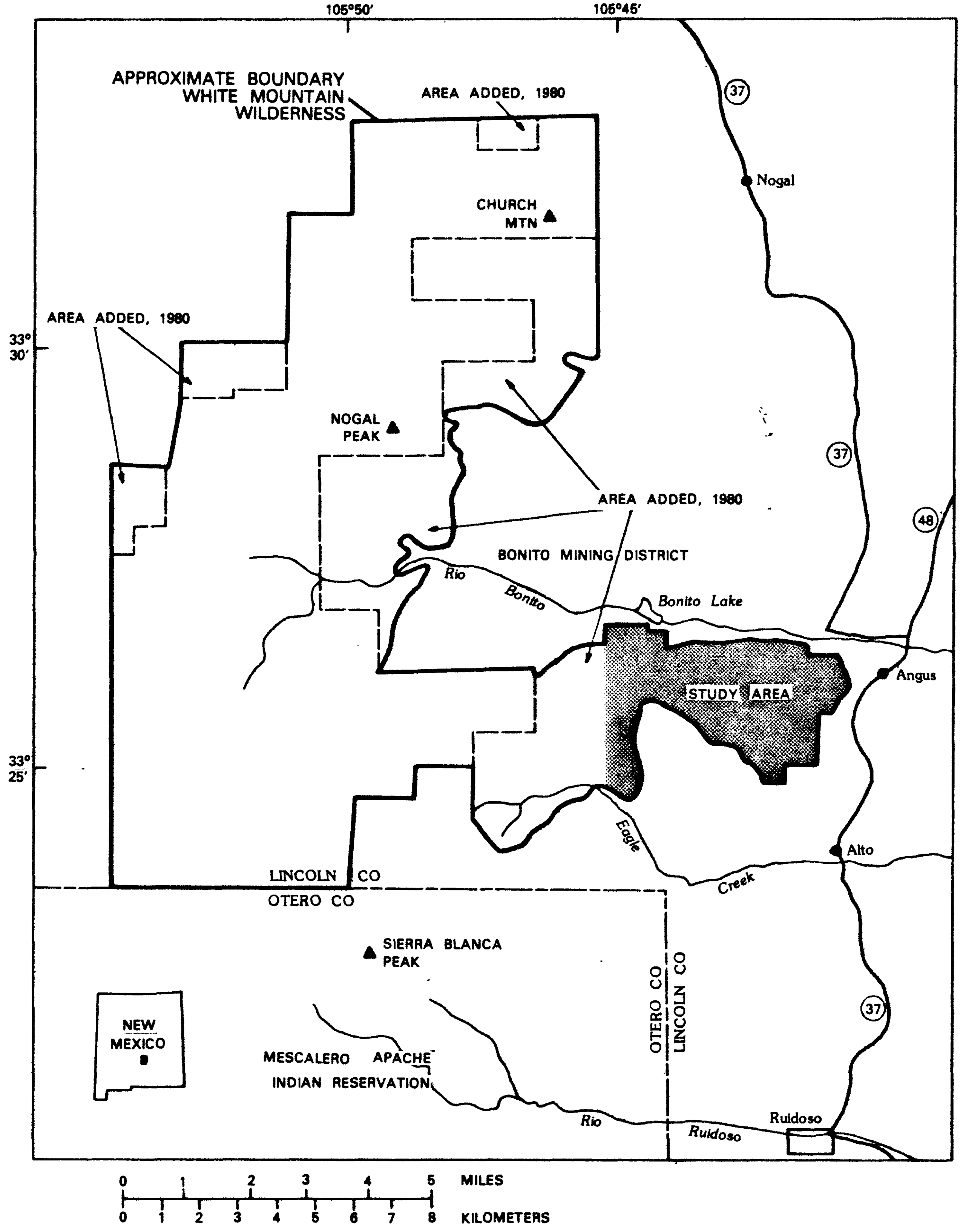

Figure 1.—Index map showing the White Mountain Wilderness and the study area (stippled) and areas added by PL-96-550 (Dec. 19, 1980).

GEOLOGY

The White Mountains are composed of sedimentary rocks and a Tertiary igneous complex. Cretaceous and Tertiary shales, siltstones, sandstones, and conglomerates of the Mesaverde, McRae, and Ogallala Formations are exposed along the flanks of the igneous complex. This complex consists of a nearly horizontal pile of Sierra Blanca Volcanics (trachyte, latite, and andesite) intruded by many stocks composed primarily of rhyolite, syenite, syenite porphyry, and monzonite. Quaternary deposits consisting of alluvium, fanglomerate, and glacial debris occur as a thin veneer of unconsolidated sediments that mantle major stream valleys, as coalescing alluvial fans that spread away from the mountain fronts to the east, west, and north, and as till in the cirque and stream valleys on the northeast flank of Sierra Blanca Peak.

Rocks exposed at the surface of the study area consist of sedimentary units of the Mesaverde (Kmv) and McRae Formations (TKm), the Walker Andesite Breccia Member of the Sierra Blanca Volcanics (Twa), and the Bonito Lake stock (Tbs) (fig. 2), which intruded the breccia.

The oldest rocks in the study area consist of the Upper Cretaceous Mesaverde Formation. In both southwestern Colorado and south-central New Mexico, the Mesaverde is divisible into a lower sandstone about 200 ft thick, a middle shale-coal unit about 200 ft thick, and an upper sandstone about 50 ft thick (Segerstrom and others, 1979).

The McRae Formation of Late Cretaceous and early Tertiary age unconformably overlies the Mesaverde Formation. First defined by Kelley and Silver (1952, p. 115-120), the formation consists largely of interbedded sandstone, shale, and siltstone, with a basal conglomerate member. The sandstone beds are commonly white to buff in the lower part and red to maroon in the upper part of the unit (Segerstrom and others, 1979).

Unconformably overlying the McRae Formation are the Sierra Blanca Volcanics, a formation of Oligocene age composed, in ascending order, of three members: Walker Andesite Breccia, Church Mountain Latite, and Nogal Peak Trachyte. The type section is found in the region of Nogal Peak, approximately in the center of the wilderness. The measured thickness of the Sierra Blanca Volcanics is about 550 ft (Segerstrom and others, 1979). Only the Walker Andesite Breccia Member is found within the study area.

The Walker Andesite Breccia Member is the oldest and thickest (2,340 ft) member of the Sierra Blanca Volcanics. The Walker consists of alternating flow and flow-breccia units. These units are locally hydrothermally altered and intruded by dikes. The flow breccias consists of more than 50 percent fragments 5-15 cm across in a matrix of plagioclase microlites. Plagioclase (An_{42} to An_{77}) and augite are the most abundant phenocrysts in the lower part of the Walker. Hornblende, biotite, and sanidine increase in abundance upward through the section, and plagioclase in microlites becomes more sodic (An_{38}) near the top of the Walker (Segerstrom and others, 1979).

Alluvial fill deposits fan out from the White Mountains within the drainages along the eastern border of the study area. Coalescing fans of alluvium are well sorted and consist of mud, silt, and sand, locally capped by calichified rock debris.

The Bonito Lake stock crops out contiguous to and within the study area. Biotite syenite constitutes the dominant rock, composed chiefly of orthoclase and plagioclase, although abundant microperthite occurs locally. Magnetite, apatite, zircon, and pyroxene are accessory minerals. Hydrothermally altered rock occurs along the northern edge of the stock, where

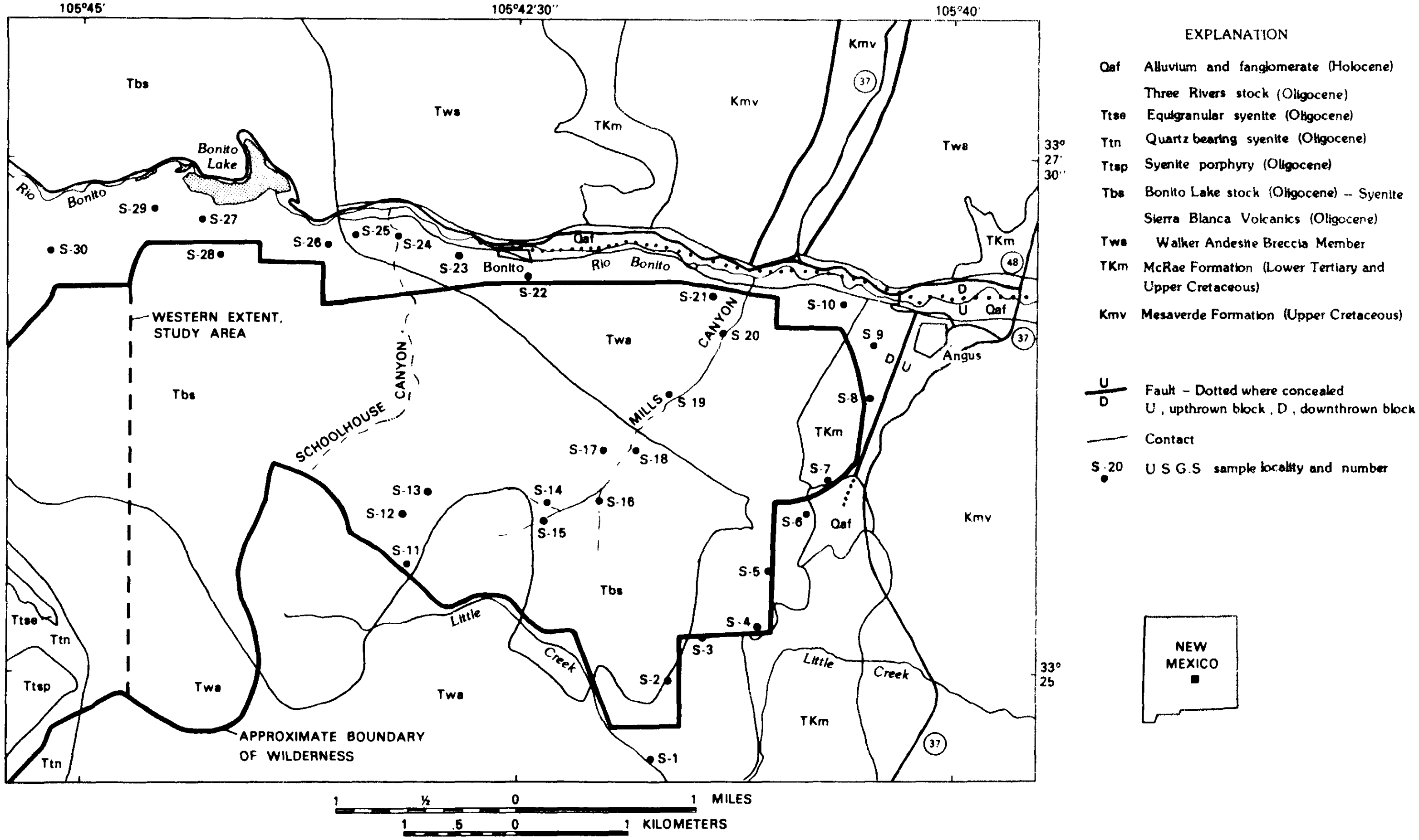

Figure 2.--Geology and sample localities of the southeast addition to the White Mountain Wilderness, Lincoln County, N. Mex.

the biotite syenite has been argilized and silicified, and where sulfides of iron, molybdenum, and copper have been introduced. A potassium-argon age determination puts the age of the stock at 26.6±1.3 m.y., late Oligocene (Segerstrom and others, 1979).

Much of the southern end of the White Mountain Wilderness and vicinity is underlain by the Three Rivers stock, which intrudes the Bonito Lake stock. This intrusion lies contiguous to the addition and extends well into the Mescalero Apache Indian Reservation south of the map area. The Three Rivers stock was the subject of a detailed study by Giles and Thompson (1972) who subdivided the intrusive body into three lithologic units and mapped a breccia zone. The units have been interpreted as representative of separate intrusive phases.

Rock of the oldest phase is a syenite porphyry consisting primarily of zoned anorthoclase phenocrysts 3-20 mm long in a groundmass of fine-grained potassium feldspar and interstitial quartz, biotite, and hornblende. The rock is 50-90 percent phenocrysts (Segerstrom and others, 1979).

Rock of the second intrusive phase is a quartz-bearing syenite which intrudes the older rock unit along the northern and eastern edges of the stock. The younger rock is classed as nordmarkite and is similar to the syenite porphyry, except that the proportion of phenocrysts, 20-35 percent, is lower (Segerstrom and others, 1979).

The youngest phase in the Three Rivers stock is equigranular syenite; it has intruded the syenite porphyry and quartz-bearing syenite, forming very irregular contacts. The equigranular syenite is finer grained (0.3-0.7 mm) but of similar composition to the other rocks in the stock (Segerstrom and others, 1979).

The Three Rivers stock has been hydrothermally altered in places, particularly along the north and east margins. The altered rock is silicified and some of it contains fine-grained pyrite and molybdenite (Segerstrom and others, 1979).

Potassium-argon age determinations from a sample within the early syenite porphyry yield an age of 25.8±1.1 m.y., late Oligocene (Segerstrom and others, 1979).

GEOCHEMISTRY

Thirty stream-sediment samples were taken by the U.S. Geological Survey (fig. 2) and analyzed for 30 elements. Sample localities are shown in figure 2. Table 1 displays the analytical results for selected elements in these samples.

The highest values of beryllium (5 and 10 ppm in samples S-8 and S-18) are not above normal background concentrations. The concentration of copper also shows no anomalies high enough to suggest mineral potential. Molybdenum was not detected in most samples; the high, 10 ppm in sample S-20, is not considered anomalous. Niobium commonly associated with rare-earth elements, showed highs in S-18 (150 ppm) and S-30 (200 ppm) that are interesting but not unusually high for a syenite from which the samples were taken. Lead concentrations are not highly anomalous in any sample (maximum is 70 ppm in samples S-16, S-18, S-26, S-27, and S-28).

MINING DISTRICTS, MINING ACTIVITY, AND MINERALIZED AREAS

During 1980, the U.S. Bureau of Mines conducted examinations in the southeast addition of prospect pits, mines, and mineral showings from which 33 chip, panned-concentrate, and mine-dump samples were taken (fig. 3).

To the north of the study area, about 0.5 mi north of the Rio Bonito, limited base and precious metal mining has occurred at the Hope, Mineral Farms, and Oso prospects (fig. 3). Prospecting for base and precious metals is evident in several parts of the southeast addition, but mining has been limited to a small gravel pit adjacent to the southwest boundary of the area, where weathered syenite was extracted for road fill.

The southeast addition straddles the assumed boundary between the Bonito mining district to the north and the Eagle Creek mining district to the south. Although the boundary has never been formally defined, claims in the Rio Bonito watershed are generally considered to be in the Bonito mining district, and claims in the Little and Eagle Creek drainages are considered to be in the Eagle Creek mining district.

The Bonito and Eagle Creek mining districts were first prospected in the early 1880's. Subsequent periods of major mining activity occurred between 1902 and 1910 and during the mid-to-late 1930's (Anderson, 1947; Segerstrom, 1979). Except for exploration and claim validation, the districts have been idle since 1941. Approximately 50 mining claims have been located within or near the addition, none patented. As of January 1980, location notices for six claims in Mills Canyon had been filed with the U.S. Bureau of Land Management.

Weathered syenite of the Bonito Lake Stock has been quarried for use as a road fill from a small pit on the southern boundary (SW1/4 sec. 23). Quarrying of this material ceased when the pit walls encountered coherent bedrock.

From 0.5 to 1 mi north of the addition, base and precious metals have been mined on a limited scale at the Hope and Mineral Farms prospects and the Oso claim. The metals occur in fissure veins and shears associated with argillic alteration zones in the Walker Andesite. Several samples collected from these workings contained lead to 1.59 percent, zinc to 0.39 percent, and copper to 0.03 percent. Sample lengths ranged from 2 to 4.5 ft. Of particular interest was the silver content of three samples: 15.0, 10.6, and 17.6 oz per ton, the latter a 2-ft chip in a prospect in a shear zone.

Fissure veins and argillized shear zones in the Walker Andesite occur within the addition and have been prospected in Mills Canyon, sec. 16, T. 10 S., R. 13 E. An argillic alteration zone occurs in Schoolhouse Canyon (secs. 7 and 8), but no evidence of mining or prospecting has been found there. Samples collected from the Silver Dollar Lode workings in Mills Canyon contain silver not exceeding 0.2 oz per ton, copper to 0.03 percent, and zinc to 0.01 percent.

Exploratory drilling for molybdenum outside the White Mountain Wilderness has taken place a few miles northwest of the study area, east of Nogal Peak, but anomalously high concentrations of molybdenum have not been found (Segerstrom and others, 1979). Molybdenum concentrations as high as 150 ppm were reported near and within the wilderness (Segerstrom and others, 1979) but similar anomalies were not found within the southeast addition.

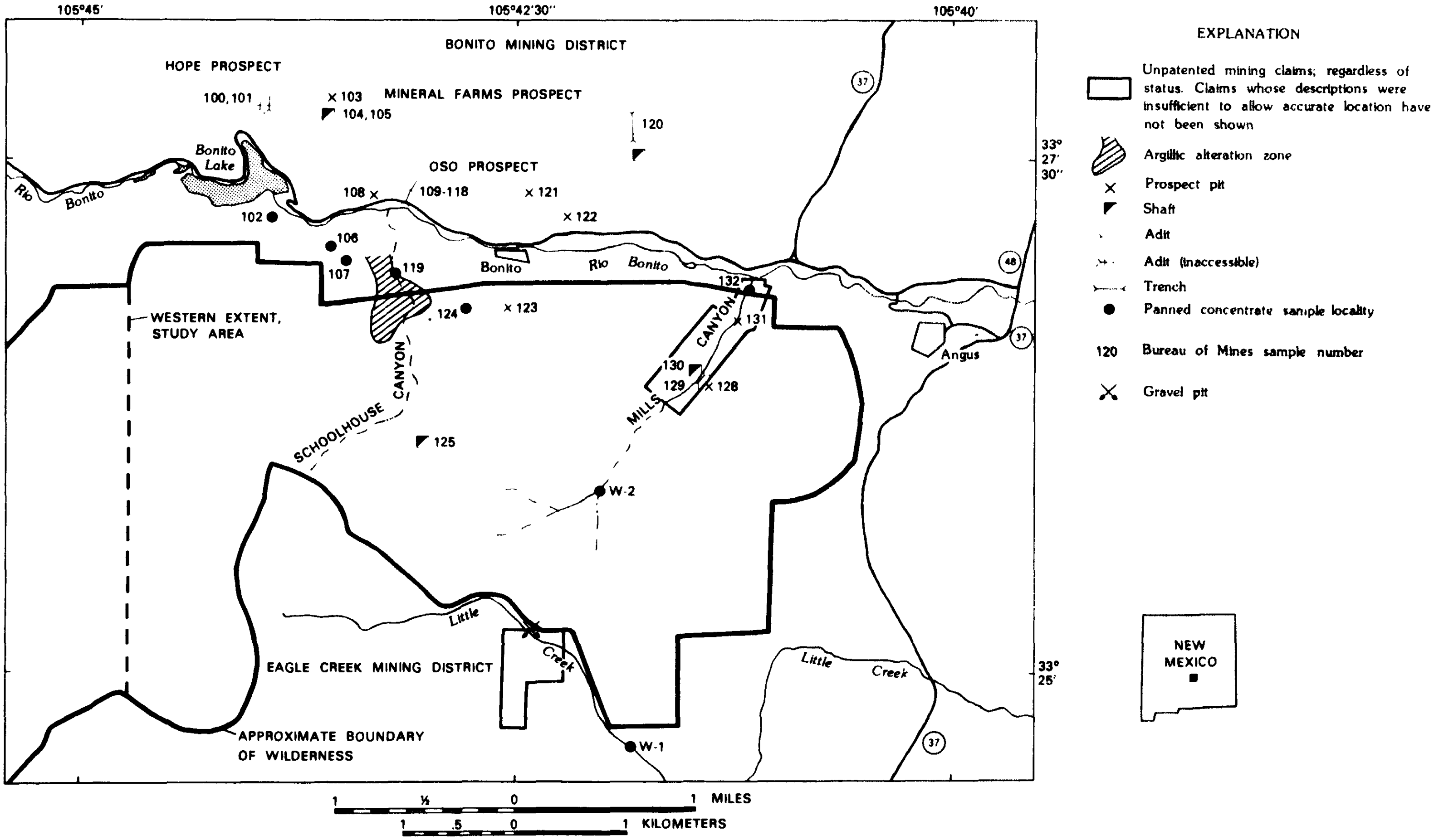

Figure 3.--Mines, prospects, and sample localities in the southeast addition to the White Mountain Wilderness, Lincoln County, N. Mex.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Mineral deposits are commonly associated with intrusive-extrusive igneous complexes similar to that underlying a large part of the White Mountains, including the southeast addition discussed in this report. Several small mining districts in scattered parts of the White Mountains have produced base and precious metal ore, and molybdenum has been sought by physical exploration a few miles northwest of the study area outside the wilderness. Thus, from a regional perspective, the geological setting of the southeast addition should be favorable for the occurrence of molybdenum and base and precious metals. Despite this geologic favorability and history of mining activity in the vicinity, veins that have been claimed and prospected in the southeast addition have, according to existing records, yielded no ore, and samples taken by the U.S. Geological Survey and the U.S. Bureau of Mines contained only trivial amounts of metals. Hydrothermally altered rock along Schoolhouse and Mills Canyon contained only very small amounts of base metals. Although there is evidence for minor mineralization, the mineral resource potential of the southeast addition is low.

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Table 1.--Semiquantitative spectrographic analyses of selected elements in stream sediments from the southeast addition to the White Mountain Wilderness, Lincoln County, New Mexico

[Number in parentheses below element symbol is lower detection limit; all values are in parts per million; L, present but in amount too low to determine; N, none detected.]

	Semiquantitative spectrographic analyses				
Field No.	Be (1)	Cu (5)	Mo (5)	Nb (20)	Pb (10)
S-1	2	50	N	50	50
S-2	2	20	N	50	30
S-3	2	50	5	50	50
S-4	1.5	50	L	30	30
S-5	2	50	N	50	30
S-6	1.5	50	N	L	30
S-7	1	50	N	L	50
S-8	10	50	N	L	30
S-9	2	30	N	L	30
S-10	2	50	N	L	50
S-11	2	30	N	50	50
S-12	3	30	5	50	50
S-13	2	20	N	L	50
S-14	1.5	30	N	70	50
S-15	2	50	N	50	50
S-16	3	50	N	70	70
S-17	3	30	5	20	50
S-18	5	20	N	150	70
S-19	2	50	N	20	30
S-20	2	50	10	30	50
S-21	1.5	30	N	L	30
S-22	2	50	N	30	30
S-23	1	50	L	50	50
S-24	2	20	N	L	30
S-25	2	50	N	70	50
S-26	2	50	L	70	70
S-27	2	50	L	50	70
S-28	3	70	L	70	70
S-29	3	50	N	50	50
S-30	2	30	N	200	50