United States Department of the Interior

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May 14, 1979 Date

~~TO~~ : ~~James C. Barker, Mining Engineer,~~ Alaska Field Operation Center, ~~Fairbanks~~

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Title ~~SUBJECT~~ : ~~Mineral reconnaissance~~ Uranium Occurrence - western Hot Springs pluton, Bettles quadrangle.

INVESTIGATIONS

Traverses were made during the 1978 field season along three ridges near the western margin of the Hot Springs pluton, Bettles quadrangle, and are indicated A, B, and C on figure 1. The ridges are composed of highly weathered and iron stained granites and felsitic rock and produced soil samples locally anomalous in U, Pb, Zn, Cu, and Mo. An isolated occurrence of the secondary uranium mineral, metazeunerite ($Cu(UO_2)_2(AsO_4)_2 \cdot 8H_2O$ - determined by x-ray powder diffraction) was found on ridge "B."

The range of values in the analyses of the soil samples and the rock types noted in float on the three ridges are listed below. Sample locations and data are found in figures 2-4 and tables 1-3.

Ridge A

Float rock included tan to dark pink chert and chert breccia; limonite stained, siliceous rhyolitic rock and highly weathered, limonite stained granitic rock.

Soils - range of values (ppm)
Cu - - 12 - 140
Pb - - <15 - 110
Zn - - 30 - 170
Ag - - all <3
Mo - - 15 - 45
U - - 0.93 - 32

The stream draining this ridge was low in all elements (Cu = 24 ppm, Pb = <15, Zn = 48, Ag = 3, Mo = <15, U = 3.1).

Ridge B

The isolated occurrence of metazeunerite was found at 1425' elevation on the center of this one mile long ridge. Mineralization consists of a few sparsely disseminated 1-2 mm flakes of the bright green secondary uranium mineral in a slabby gray-green silicified and sericitized granitic rock in rubble crop. Mineralization was found in just a few pieces of the rock. The slabby nature of this rock suggests it originated along a joint or fracture plane. A high

graded sample analyzed at 1000 ppm U.

Uranium mineralization on this ridge is not concentrated enough to significantly deflect a scintillometer carried along at waist height. Maximum deflections noted were 50 cps higher than the background of 250 cps while carried at waist height. Greater differences were found by placing the scintillometer on the surface of the ground and even larger (from 250 - 600 cps) by placing the scintillometer in a shallow hole dug with a rock hammer.

Float rock on the ridge consisted of iron stained (both orange limonite and deep red hematite) granitic and rhyolitic rock. Very siliceous and sericitized rock is common. Quartz veining is locally quite prevalent on the ridge but conspicuously not radioactive. An outcrop at the base of the ridge, along the northeast side, approximately 200 yards from the Kanuti River (location 9961R) is composed of the most radioactive rocks seen in place (only 450 cps). This outcrop consists of a limonite coated, very siliceous felsite cut by numerous small quartz veins.

Two separate soil sampling traverses were taken along the ridge. In one, soil samples were collected essentially from the surface using a rock hammer to dig a shallow 6" sample hole. The second traverse was made with a soil auger and samples were obtained from a depth of approximately 18" to 24". It was hoped that a more definitive anomalous zone could be obtained with a deeper sample. As the data below shows, lead and zinc values were higher in the deeper samples while copper and uranium were higher from the samples collected from the surface. Unfortunately it was not possible to duplicate the shallow sample sites with the auger traverse so that a definitive statement comparing the two techniques in this region can not be made. (Samples collected from the other ridges were shallow.)

Ridge B - Range of values (ppm)

deep 6" samples		deep 18" - 24" samples	
Cu	5 - 45	Cu	5 - 36
Pb	<15 - 100	Pb	<15 - 200
Zn	38 - 290	Zn	36 - 380
Ag	<3	Ag	<3
Mo	<15	Mo	<15
U	4.5 - 79	U	5 - 37

Streams draining this ridge ran:

Cu	Pb	Zn	Ag	Mo	U
16	<15	58	<3	<15	13
18	<15	63	<3	<15	- -

Ridge C

Outcrop on this ridge is composed of a limonite stained highly weathered granitic rock, locally intruded by small (2 ft. thick) rhyolite dikes. Vein quartz, diabase and aplite occur in float rubble.

Ridge C - Range of values in soils

Cu - - 3-14
Pb - - 15-60
Zn - - 52-220
Ag - - 3
Mo - - 15
U - - 13-48

All caps & Center no underline

Summary and recommendations

Unlike the bulk of the pluton which is predominantly a homogeneous, medium-to coarse-grained biotite quartz monzonite, this area is intruded by later fine grained felsitic, aplitic and quartz rich phases. These rocks may be related to the TKV (Tertiary-Cretaceous Volcanic) unit mapped to the west. The relation of the diabase float rock to the granitic rock on Ridge C is unknown and if it is intrusive and originates from the JPV unit (mafic volcanic and intrusive rock) would indicate an older age for the granitic rock than the Cretaceous dates now assigned.

The region appears to have potential for stockwork and porphyry type deposits of copper, molybdenum and/or uranium related to the hydrothermally altered granitic rock. Metazeunerite (the secondary uranium mineral found on Ridge B) is commonly found in the oxidized zone of deposits containing uraninite together with primary minerals containing arsenic such as smaltite, a cobalt and nickel arsenate, and enargite (Cu_3AsS_4), an ore of copper. Anomalous cobalt found in pan concentrates from this region further suggest the possibility that hydrothermal occurrences of cobalt may exist.

This region is quite obvious from the air as the ridges are vegetation free and an anomalous orange-limonite stained color.

Suggestions for follow-up work include an aerial survey to determine the extent of the iron stained granitic rocks. A portion of the region should be mapped to determine contact relations of the varying map units and granitic phases and the extent and types of alteration. Additional soil geochem should be conducted in any new areas found. It is possible that a magnetic low may exist over hydrothermally altered portions of the pluton due to the removal of magnetite.

Figure 2. Sample locations, Ridge A

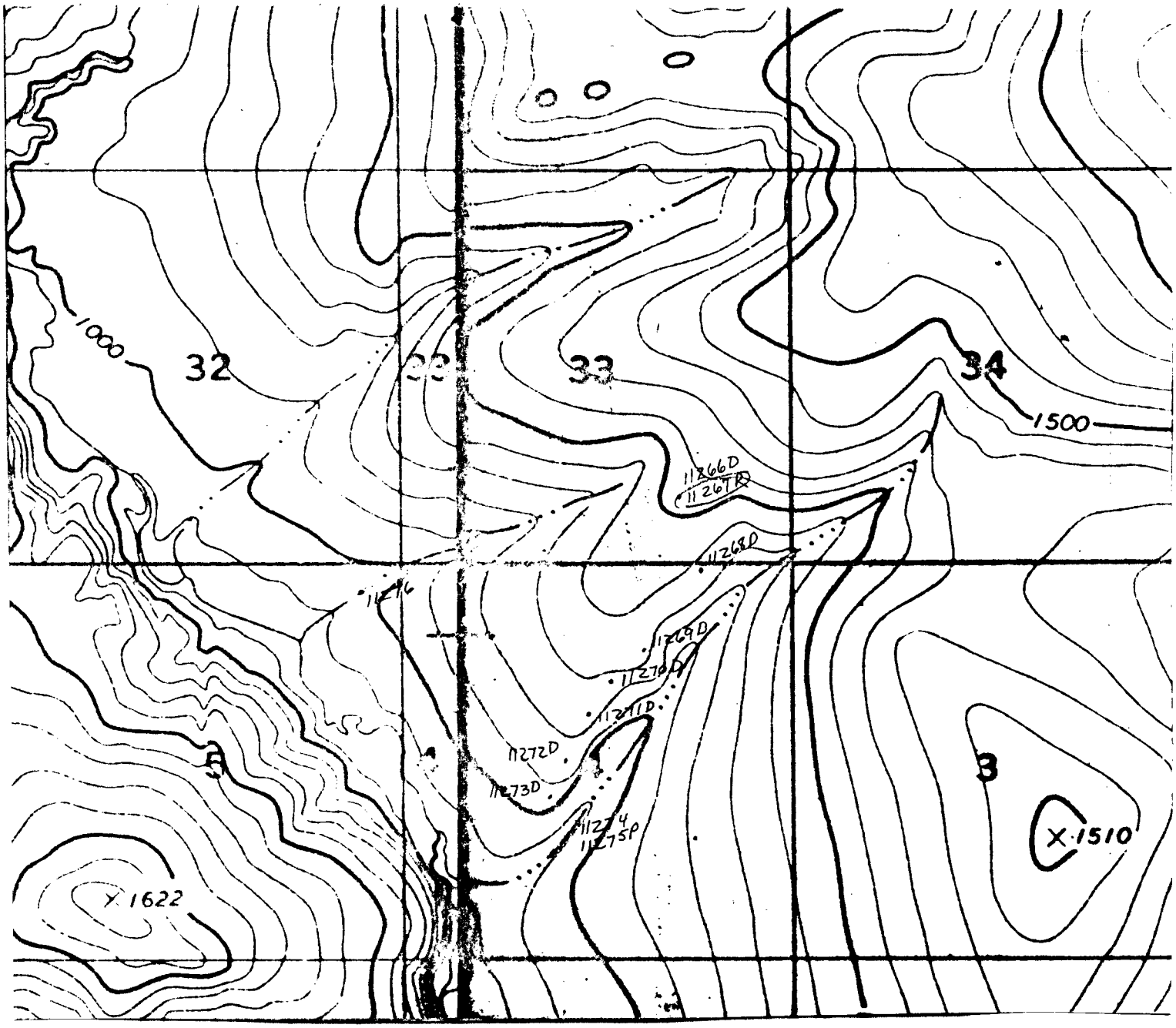
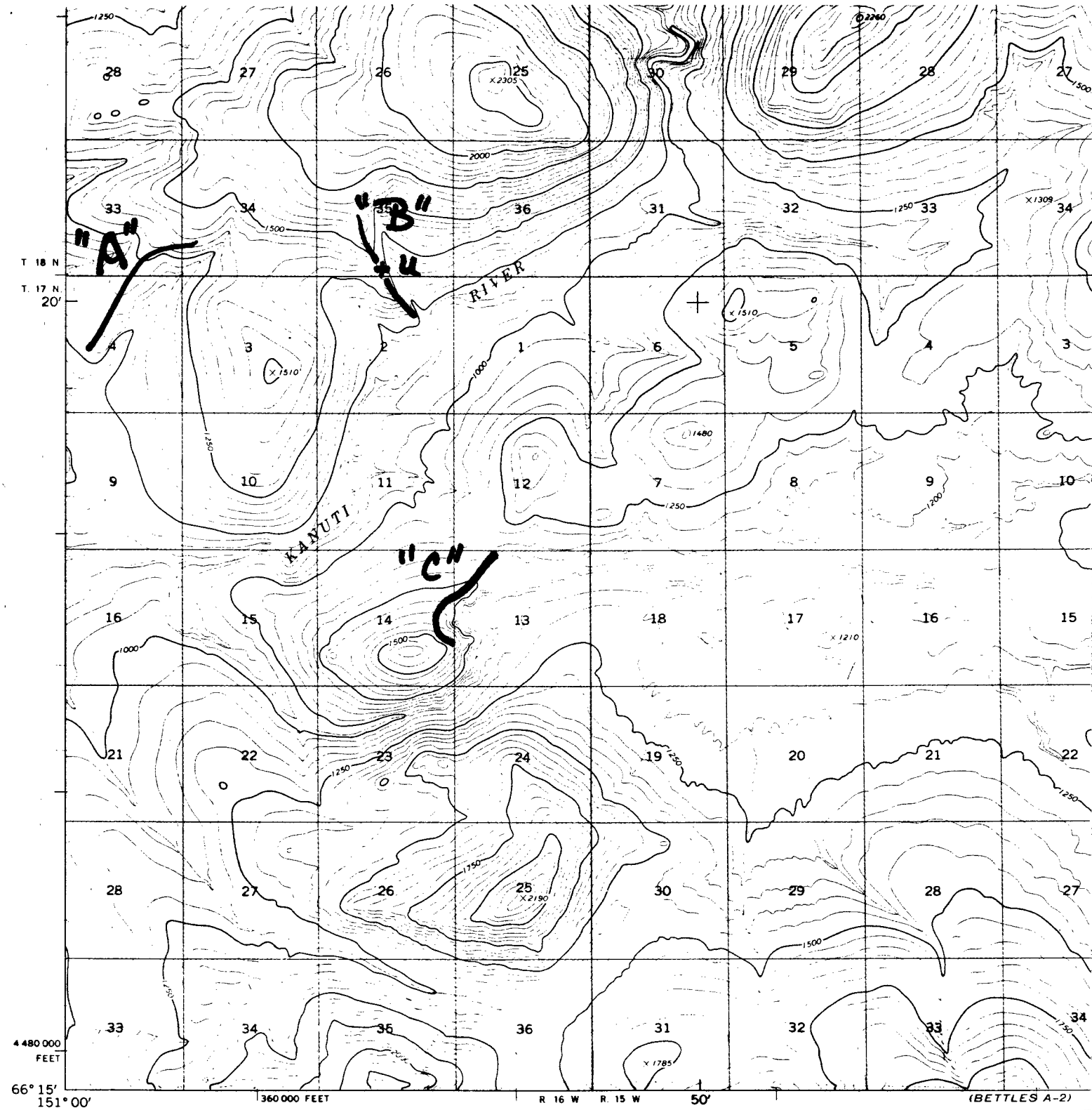


Figure 1. Location map of ridges found to have soils locally anomalous in U, Pb, Zn, Cu, and Mo.



Bettles B-2
Scale - 1:63,360

Figure 4. Sample locations, Ridge C

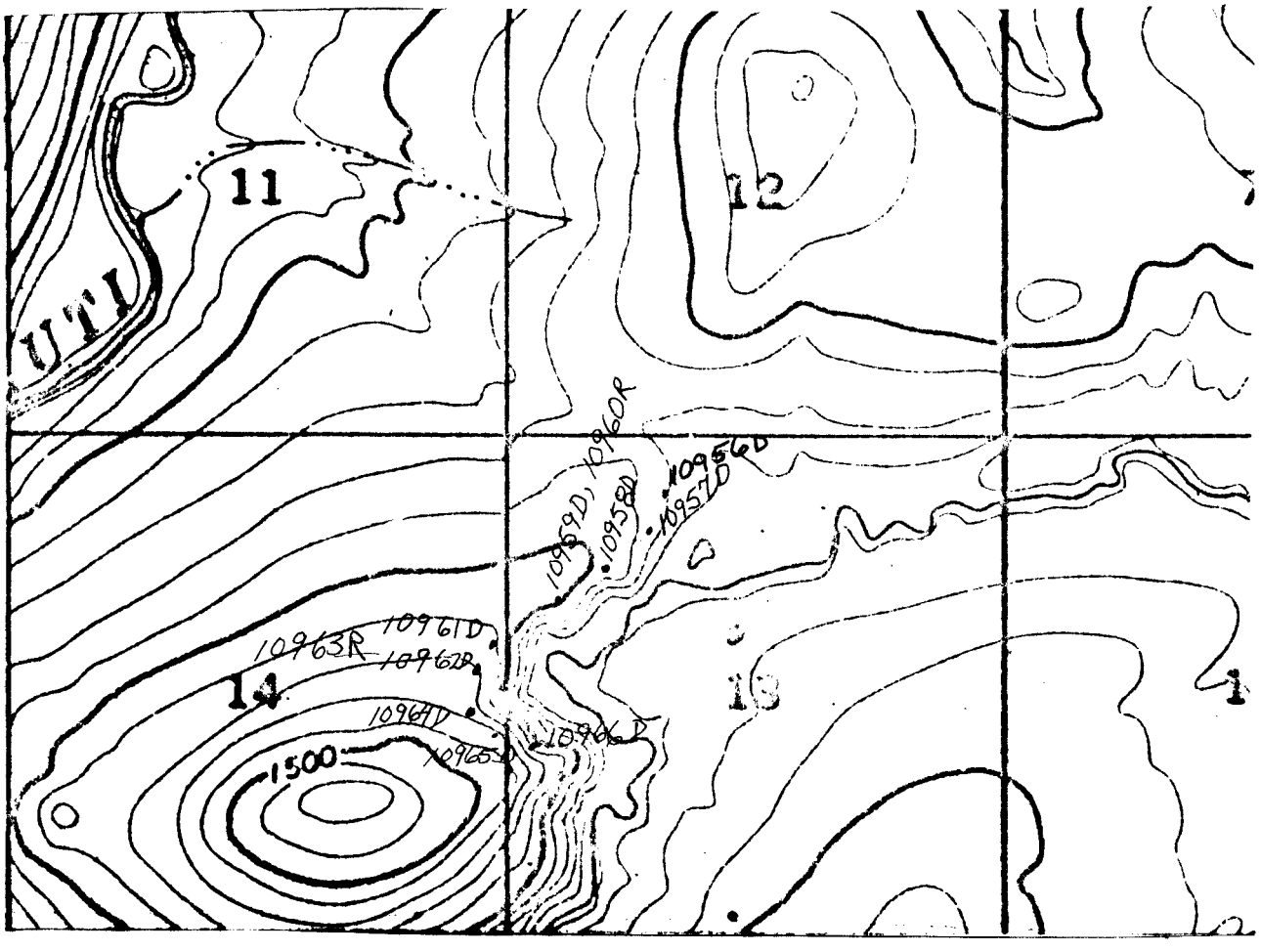


Table 1. Sample analyses, Ridge A (ppm)
(for sample locations see figure 2)

Smpl #	Type	Reno #	Cu	Pb	Zn	Ag	Mo	U
11266	D	E8-4411	43	<15	59	<3	<15	2.2
11268	D	4412	42	65	30	"	"	7.8
11269	D	4413	12	95	58	"	15	17.
11270	D	4414	32	85	130	"	45	26.
11271	D	4415	140	100	170	"	25	30.
11272	D	4416	120	25	40	"	<15	0.93
11273	D	4417	11	110	135	"	15	32.
11274	S	4418	24	<15	48	"	<15	3.1
11276	S	4419	12	"	33	"	"	2.7

Table 2 (continued)

Soil samples collected at 0-6" depth

Smpl #	Reno #	Cu	Pb	Zn	Ag	Mo	U Reno	U R.AA
9936	F8 - 2585	5	15	50	<3	<15	5.0	-
9939	2586	10	15	130	"	"	14.	-
9941	2587	11	15	56	"	"	11.	-
9943	2588	14	20	47	"	"	11.	10
9945	2589	7	25	38	"	"	13.	-
9947	2590	45	40	110	"	"	32.	42
9949	2591	13	55	170	"	"	23.	-
9951	2593	6	30	50	<3	<15	11.	-
9952	2594	9	70	96	"	"	79.	69
9954	2595	8	100	130	"	"	23.	-
9955	2596	19	30	68	"	"	6.4	-
9957	2597	22	40	83	"	"	8.1	-
9958	2598	9	90	195	"	"	29.	34
9959	2599	16	35	71	"	"	7.2	-
9960	2600	11	25	59	<3	<15	4.5	4.0

Stream sediment samples

Smpl #	Reno #	Cu	Pb	Zn	Ag	Mo	U
9861	2523	16	<15	130	<3	<15	5.1
9962	2601	23	15	160	"	"	19
11278	21	18	"	63	"	"	—
9855	2520	25	"	160	"	"	4.7

TABLE 2. Sample analyses Ridge B. (ppm)
(for sample locations see figure 3.)

Soil samples collected at 18"-24" depth

Smpl #		Reno #	Cu	Pb	Zn	Ag	Mo	U
9414	D	F8 4355	36	200	50	<3	<15	22
9416	D	56	9	25	62	"	"	15
9417	D	57	5	<15	52	"	"	6.6
9418	D	58	15	15	89	"	"	6.3
9419	D	59	12	<15	34	"	"	15
9420	D	60	20	25	60	"	"	22
9421	D	61	11	30	71	"	"	5.0
9422	D	62	20	50	140	"	"	16
9423	D	63	9	85	350	"	"	33
9424	D	64	6	25	96	"	"	11
9425	D	65	6	45	36	"	"	6.8
9426	D	66	22	35	81	"	"	5.6
9460	D	67	5	50	165	"	"	37
9461	D	68	15	50	72	"	"	19
9462	D	69	11	60	100	"	"	24
9463	D	70	7	35	110	"	"	21
9464	D	71	18	<15	58	"	"	8.5

Table 3. Sample analyses, Ridge C (ppm)
(for sample locations see figure 4)

Smpl #	Type	Reno #	Cu	Pb	Zn	Ag	Mo	U
10956	D	FB-4402	14	75	150	<3	<15	30.
10957	D	03	<3	20	56	"	"	29.
10958	D	04	4	<15	86	"	"	27.
10959	D	05	3	"	52	"	"	29.
10961	D	06	7	50	190	"	"	48.
10962	D	07	6	35	66	"	"	13.
10964	D	08	3	45	220	"	"	35.
10965	D	09	7	60	170	"	"	41.
10966	D	10	3	40	60	"	"	—