III: DISCUSSIONS AND COMMUNICATIONS

URANIUM IN NISLING RANGE ALASKITE AND RELATED ROCKS OF YUKON CRYSTALLINE TERRANE: DISCUSSION

W.D. Goodfellow, I.R. Jonasson, and B.W. Smee
Resource Geophysics and Geochemistry Division
Geological Survey of Canada, 601 Booth St., Ottawa K1A 0E8

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Introduction

A very interesting paper by Tempelman-Kluit and Currie (1977) provides considerable basic geochemical data on abundance of uranium in the Nisling Range alaskite and related rocks. By way of comment, we offer some further geochemical data on uranium and certain accessory or indicator elements in these same rocks and from similar suites elsewhere. Certain aspects of the paper require clarification. We shall point out these and discuss them in turn because the conclusions drawn by Tempelman-Kluit and Currie may be affected significantly by them.

Discussion

The first omission we note is the absence of any description of analytical methods, particularly for uranium. It is quite important to know whether analyses followed partial attacks by hot acid or total dissolutions, or whether some other total determination such as neutron activation analysis was employed. Depending on the chemistry and especially the mineralogy of uranium (and other metals) in these samples, the abundances measured may change considerably according to method employed.

Table 1 presents some trace analytical data for granitoid rocks similar to those studied by Tempelman-Kluit and Currie. Analyses were made by the following methods.

Zn, Cu, Pb, Mo and Ba: quantitative DC arc spectrography

W,F: colorimetry and ion electrode, respectively, following total decomposition of sample by fusion

Th: X-ray fluorescence (powder)

U_1: strong nitric acid attack, fluorometric finish

U_2: total U by delayed neutron activation analysis.

It is clear that U values found are quite dependent on the analytical method employed. It is difficult to compare the data of Table 1 with those of the authors because we do not know how U was determined. Moreover, comparisons with data provided by one of us (B.W.S.) are also in doubt because most of the North American data quoted derive from a few samples of unknown weathering history, with U determined by neutron activation. Those from Japan were analyzed by methods unknown.

Table 1. Trace element data for some granitoid rocks. (ppm)

Sample	Number	Rock unit	Zone	Easting	Northing	Zn	Cu	Pb	Mo	W	F	Th	U_1	U_2	Ba	Location
104N	765001	GRNT	8	594100	6614700	71	6	20	0.5	-	-	-	-	12.0	118	Surprise Lake, Atlin.
104N	765002	GRNT	8	594100	6614700	53	4	6	0.5	-	-	-	-	10.5	579	Surprise Lake, Atlin.
104N	765003	ALSK	8	594100	6614700	58	4	1	0.5	-	-	-	-	25.4	205	Surprise Lake, Atlin.
104N	765004	ALSK	8	594100	6614700	122	6	100	0.5	-	-	-	-	33.4	274	Surprise Lake, Atlin.
104N	769005	GRNT	8	563800	6619800	48	2	10	1.1	-	-	-	-	4.0	1500	Deep Bay, Atlin.
105F	752022	QZFP	8	635000	6819500	137	12	30	16	6	1730	72	4.4	13.9	950	McConnell Ck, Pelly Mts.
105F	752023	SYNT	8	635000	6819600	550	9	100	10	0	6100	109	8.0	19.5	890	McConnell Ck., Pelly Mts.
105F	752024	SYNT	8	635000	6819700	625	11	43	6	4	5650	75	12.5	22.6	996	McConnell Ck., Pelly Mts.
105F	752025	SYNT	8	635000	6819800	155	4	27	22	0	22000	35	16.1	25.7	563	McConnell Ck., Pelly Mts.
105K	752014	GRNT	8	589200	6907000	25	2	17	1	0	1320	39	2.1	9.4	1597	Mt. Mye
105F	752019	GRNT	8	635000	6819100	345	8	79	5	5	900	5	0.1	7.1	418	Mt. Mye
115P	752089	GRNT	8	373400	7074800	18	1	16	0	0	770	11	6.4	7.8	467	Ura, Clear Creek
115P	752091	GRNT	8	372900	7074200	32	2	14	1	0	550	34	4.8	8.8	604	Ura, Clear Creek
115P	761001	GRNT	8	372900	7074200	59	7	23	0.5	-	108	-	-	10.8	1142	Ura, Clear Creek
115P	761002	GRNT	8	372900	7074200	150	3	19	3.1	-	340	-	-	58.3	342	Ura, Clear Creek
115P	761003	GRNT	8	372900	7074200	122	5	24	2.7	-	370	-	-	28.8	345	Ura, Clear Creek
115P	761004	GRNT	8	372900	7074200	95	9	32	1.2	-	455	-	-	25.3	655	Ura, Clear Creek
115P	761005	GRNT	8	372900	7074200	102	12	38	2.6	-	148	-	-	12.3	1500	Ura, Clear Creek
115J	752095	ALSK	7	611100	6915500	69	0	11	2	0	280	18	3.0	5.6	385	Klotassin River
115J	752096	ALSK	7	611200	6915500	74	2	12	2	0	550	22	2.8	6.0	628	Klotassin River
115J	752097	ALSK	7	611300	6915500	60	2	11	2	0	1700	33	4.4	8.5	566	Klotassin River
115J	752098	ALSK	7	610900	6915500	67	2	11	2	0	115	20	2.0	5.7	559	Klotassin River
115J	752099	ALSK	7	610800	6915600	52	1	10	2	0	1060	25	4.6	7.7	229	Klotassin River
115J	761001	MNZN	7	628000	6950800	35	194	25	5.0	6	680	-	12.0	15.6	825	drill core,266 feet
115J	761003	MNZN	7	628000	6950800	25	22	18	1.0	1	68.)	-	3.8	5.6	1398	drill core,984 feet
116B	765002	MNZN	7	617850	7150000	16	9	40	7.9	2	415	-	9.4	16.4	540	Tombstone Mts.
116B	765003	MNZN	7	617850	7149120	68	2	40	3.8	2	3900	-	13.6	22.2	330	Tombstone Mts.
116B	765004	MNZN	7	617460	7149088	36	3	17	2.5	2	700	-	34.0	60.0	210	Tombstone Mts.
116B	765005	MNZN	7	616950	7147140	47	4	32	2.5	4	586	-	3.6	5.1	1880	Tombstone Mts.
116B	765006	SYNT	7	616620	7146760	16	4	17	3.8	4	610	-	2.4	3.0	1860	Tombstone Mts.
116B	765007	SYNT	7	614750	7144910	68	5	48	7.2	4	760	-	5.2	10.0	1840	Tombstone Mts.
116B	765008	SYNT	7	614752	7142900	54	4	64	11.6	4	2350	-	20.0	31.3	470	Tombstone Mts.
116B	765009	SYNT	7	614752	7142900	88	3	80	3.8	2	1280	-	16.8	26.1	1560	Tombstone Mts.
116B	765010	TNGT	7	614752	7142900	91	4	48	4.4	2	785	-	14.4	24.7	230	Tombstone Mts.
116B	765014	TNGT	7	616180	7141900	18	1	20	3.8	2	785	-	2.8	3.9	200	Tombstone Mts.

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A second consideration not discussed by the authors concerns the weathering history of the "surface rock samples" studied. Much of the area from which these samples came is underlain by unglaciated terrain. Our own observations made in the Klotassin River area confirm that deep leaching of the alaskitic rocks therein has taken place. The effect on all trace metal levels is quite pronounced.

Table 1 includes a few examples of leached alaskite (115J). U levels are low and there is little difference between partial and total determinations indicating that much of the easily leached U, e.g., perhaps that associated with fluorite, micas or sulphides, has been removed as the host minerals were destroyed by weathering.

The usefulness of subtle comparisons of mean U levels for plutonic rocks and volcanic rocks is also in question since small differences measured in weathered rocks may merely reflect differences in mineralogy and leachability. Thus there is some doubt that U levels measured in any surface rock samples from unglaciated terrain reflect original composition no matter what analytical method might be employed.

Analyses of two samples of unweathered quartz monzonite from drill core have been added to Table 1. It is of interest to note that the ratio of total U to extractable U is not all that different from other examples in the Table.. However, there are too few samples here to be of real use in interpretation.

We have presented data for a number of other alaskites, granites and syenites from glaciated terrain for comparison. It is probable that these specimens are considerably "fresher" than those from the Nisling Range. Certainly samples from the Tombstone Mountains and Atlin were observed to be quite fresh. We make no comment here on the effects of weathering on other metals, however comparison with data published by Jonasson and Goodfellow (1976) will yield some interesting relationships.

Finally we would point out that attempts to assess a given rock unit in terms of its potential as a host for U mineralization must be made with caution given the doubts which can be cast on the value of geochemical data at hand. We agree with Tempelman-Kluit and Currie that the Nisling Range alaskite should be regarded as a source of U which could be redeposited elsewhere. Moreover we would add that there is also a good chance of forming zones of supergene enrichment within the body of the intrusive itself. The fact that U continues to be mobile is reflected in anomalous levels in stream and spring waters percolating through the alaskite body (Jonasson and Gleeson, 1976). We consider that the combined use of water, sediment and rock sampling may lead to the detection of easily leached supergene U mineralization.

References

Jonasson, I.R. and Gleeson, C.F.
1976: On the usefulness of water samples in reconnaissance surveys for uranium in Yukon Territory; Report of Activities, Part C, Geol. Surv. Can., Paper 76-1C, p. 241-244.

Jonasson, I.R. and Goodfellow, W.D.
1976: Uranium reconnaissance program: orientation studies in uranium exploration in the Yukon; Geol. Surv. Can., Open File 388, 97 p.

Tempelman-Kluit, D.J. and Currie, R.G.
1977: Uranium in Nisling Range alaskite and related rocks of Yukon Crystalline Terrane; Report of Activities, Part C, Geol. Surv. Can., Paper 77-1C, p. 89-94.

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URANIUM IN NISLING RANGE ALASKITE AND RELATED ROCKS OF YUKON CRYSTALLINE TERRANE: REPLY

D.J. Tempelman-Kluit and R.G. Currie
Regional and Economic Geology Division
Geological Survey of Canada, 100 West Pender St., Vancouver, B.C. V6B 1R8

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We welcome the discussion of Goodfellow, Jonasson and Smee and are gratified they agree with our conclusion concerning the uranium possibilities of the Nisling Range alaskite. Our failure to specify the analytical technique used for our uranium determinations was a serious oversight as their discussion demonstrates. Our uranium analyses were by neutron activation with delayed neutron counting and were done at the laboratory of the Atomic Energy Commission in Ottawa. Our results should therefore be compared with the "U2" analytical values quoted by Goodfellow, et al. and give similar values to the samples they analyzed. Comparison of our results with the North American data was therefore valid.

Goodfellow, Jonasson and Smee observe that we did not discuss the weathering history of the rocks of the rocks and point out that the unglaciated and weathered nature of the rocks of the Klotassin River region implies deep leaching and removal of a large proportion of the original uranium. We refrained from discussing the weathering history because its relationship to the degree of uranium leaching is not understood and because the glacial history and physiographic development is detailed elsewhere (Tempelman-Kluit, 1974). We caution Goodfellow et al. in equating deep weathering with deep leaching. The "freshness" of a rock sample is no guarantee that its uranium has escaped leaching. Similarly derivation of samples from glaciated or unglaciated regions bears no simple relationship to the completeness or depth to which the rocks are leached of uranium. This is illustrated by their own data using one of their criteria, namely the ratio of total uranium to partial uranium. For their 9 samples from the unglaciated part of Yukon this ratio is 1.8 ± 0.5 and for their 15 samples from the glaciated part 2.0 ± 0.8 (we neglect the outlier from Mt. Mye); statistically indistinguishable.

We do not necessarily disagree with the conclusion that rocks in Klotassin River area are deeply leached of uranium, but we do disagree that their "own observations confirm the deep leaching of the alaskitic rocks...". Their analyses of 5 surface specimens and 2 of drill core from depths of 266 and 984 feet in the alaskite have similar U concentration excepting the sample from 266 feet. This suggests only that the rocks are either all leached equally to a depth of 984 feet or that all have escaped leaching equally.

Goodfellow, Jonasson and Smee also state that in the "few examples of leached alaskite (115 J). U levels are low and there is little difference between partial and total determinations...". In rocks from which uranium is naturally leached the ratio total to partial uranium should increase progressively, not decrease as they imply, and the difference should also increase. This suggests for example that sample 752019 from Mt. Mye has been more effectively leached than the samples from the Klotassin River.

We consider the differences in mean uranium levels of the various rock units significant for the very reasons Goodfellow et al. distrust them. Namely, they reflect differences in mineralogy and leachability in the rocks.

This discussion emphasizes the problems in interpreting uranium geochemical data and that more effort must be focussed on interpreting the results rather than on acquiring more data.

Reference

Tempelman-Kluit, D.J.
1974: Reconnaissance geology of Aishihik Lake, Snag and part of Stewart River map-areas, west-central Yukon; Geol. Surv. Can., Paper 73-41, 97 p.