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URANIUM PROSPECTING FOR ACCURATE TIME-EFFICIENT SURVEYS OF RADON EMISSIONS IN AIR AND WATER, WITH A COMPARISON TO EARLIER RADON AND HE SURVEYS

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ABSTRACT

Ur-Energy Inc. is focusing its exploration efforts on discovery of an Athabasca-style unconformity-associated uranium deposit in the Thelon Basin, NWT, Canada. This work describes the exploration methodology and results to date of electret ion chamber (EIC) radon surveys employed in the summer of 2005 in the search for a deeply buried, high grade uranium deposit at Ur-Energy's Screech Lake Property. The survey has demonstrated that accurate radon gas measurements covering sizeable surface areas can be obtained within three days under variable summer field conditions. A total of 433 ground-EIC measurements were completed over a grid measuring 3 km by 1.5 km and centered on Screech Lake. In addition 26 water samples from streams and lakes in the area were measured for radon content. Current work has confirmed, extended, and refined historic results obtained in past explorations that included radon and radiogenic helium surveys. The work was done using commercially available E-PERM® EIC system with one litre chambers. Additionally new radon anomalies have been discovered. This work has rekindled interest in using practical, short duration radon surveys for uranium exploration.

INTRODUCTION

Ur-Energy Inc. is focusing its exploration efforts on discovery of an Athabasca-style unconformity-associated uranium deposit in the Thelon Basin, NWT, Canada. The exploration efforts were aimed in the search for a deeply buried, high grade uranium deposit at Ur-Energy's Screech Lake Property. This has become important due to recent renewed interest in Nuclear Power. The object was to review the earlier exploration efforts and employ latest technologies to improve upon the previous work with a technique usable in exploration setting and provide fast results.

During the period 1976-80 Screech Lake was the scene of successive exploration efforts by Urangesellschaft Canada Ltd. (UG). Their efforts were directed at exploring for a radioactive source(s) of very anomalous amounts of radon and helium gases emanating from the lake and surroundings. Accordingly, UG completed radon and radiogenic helium surveys on Screech Lake and surrounding area. The 2005 Ur-Energy radon results replicate and refine the UG results.

When radon surveys were done during that era, the techniques were not that sophisticated and much data had to be rejected to draw some general conclusions.

Several exploration methodologies are available. These include gamma surveys, radon surveys and He in the soil surveys and radon in water in the streams. Uranium leads to radon gas which penetrates through the soil and releases to air. Gamma ray emitted from deeply buried uranium is another signal, but less specific. The radioactivity associated with uranium release alpha particles, which are simply He atoms and these get adsorbed in the soil. He in the soil is another useful signal. In the current exploration efforts, it was decided to use measurement of radon in air and radon in water in the flowing streams. The results were meant to compare the results with earlier historical data and improve upon them, using later technologies.

When radon survey was done more than 20 years back, the techniques (AT techniques) were not that sophisticated and lots of data had to be rejected to draw some general conclusions.

The present efforts were aimed at getting large number of results in exploration setting in 3 to 4 days with an acceptable accuracy. Large volume (one litre volume) electret ion chambers (EIC) was chosen. Exposure duration was chosen to be about 3 days. Same staff members responsible for deployment and retrieval were able to do the analysis and complete the report with in one week. This has sufficient sensitivity to measure 0.5 pCi/L in 3 days. Rad Elec's standard method was also used for measuring radon in water samples collected from streams.

PROTOCOL

Large volume (1 litre) Electret ion chamber (HST E-PERM) was enclosed in Tyvek Bag. It is placed into a small pit, 2 feet x 2feet x 6 inches. The pit is covered with a breathable, water resistant sheet and edges were weighted down with soil and pebbles found around that area. The latter step prevents the cover from flying off in frequently found windy conditions. Tyvek being transparent to radon, the enclosed EIC measures radon emanating from the area of the sample site.

Pre-measured electret in cap was loaded to EIC chamber in the field. At the termination of the sampling, electret was removed and covered with cap for later measurement. Assemblies can be used several times. Trial tests were done in a back yard setting before starting a large scale deployment in exploration setting.

Analysis was done using standard spread sheet to calculate the results in any required format and units. Assuming the gamma level of 10 μR/h, the radon calculations were done. This is not exact because gamma background can be higher at certain locations due to the presence of uranium. Since gamma signal over and above normal background of 10 μR/h is another positive signal for the presence of uranium; combined signals may be better suited for the purposes uranium prospecting.

RESULTS

Table 1 gives typical sample set of results of Radon in air.
Table 2 gives typical sample set of results of radon in water.
Figure 1 gives Location of exploration.
Figure 2 gives partial contour map.

A total of 433 ground-EIC measurements were completed over a grid measuring 3 km by 1.5 km and centered on Screech Lake. In addition 26 water samples from streams and lakes in the area were measured for radon content. Current work has confirmed, extended, and refined historic results obtained in past explorations that included radon and radiogenic helium surveys. A detailed project report is available for those interested in further details.

Results revealed overlapping conductive horizons both deep within the Thelon sandstones and at the sandstone/basement unconformity. These conductors may reflect a deep zone of intensive clay alteration perched within the sandstones and a conductive thick regolith horizon. A pronounced ovoid magnetic feature, present in the basement rocks, underlies the Screech Lake area. Geophysical results indicate basement depths of 600 meters beneath Screech Lake.

The radon anomalies appear at surface as linear features. The radon survey results, when integrated with the structural interpretation, suggest that radon is rising to surface along structures from deep source(s) within the Thelon sandstone or from the Thelon/basement unconformity. Ur-Energy's work in 2005 has confirmed, extended, and refined historic results obtained in past exploration at Screech Lake.

FUTURE DIRECTIONS

In 2006 exploration, Ur-Energy has expanded the current method to include the use of radon flux monitors (RFM) which use EIC technology. Ur-Energy has successfully introduced the use of the radon flux monitor (RFM) system, thereby reducing a 3-day reading period to an 8-hour reading period. Both systems are now being utilized

Use of the HST system on a reconnaissance basis, on a completely separate property (from Screech) Ur-Energy has located a very high radon concentration in a sandstone-unconformity style geological setting, which will become the focus of a more detailed program next year.

The RFM system is more difficult to use in difficult sampling conditions such as rocky soil and wet vegetation such as peat, and the local conditions must be accounted for in each sample reading.

Ur-Energy's testing to date indicate that measuring radon flux from ground may be a more suitable and time efficient substitute for measuring radon at ground level. Future explorations may utilize this method.

CONCLUSIONS

Relatively low priced radon measurement technology is usable for accurate time-efficient surveys of radon emissions in air and water. The EIC technology, when applied to uranium exploration, is proving to be a highly efficient method for locating radon anomalies, which may originate in primary uranium concentrations.

It is concluded that radon is rising to surface along structures from deep source(s) within the Thelon sandstone and/or from the Thelon/basement unconformity. A structural interpretation of the Screech Lake area has resulted from the 2005 EIC radon survey. The survey has provided reinforcement for deep exploration drilling for unconformity-type uranium mineralization at Screech Lake.

Table-1
Typical sample set of Data
Radon in Air

	UTM				Gamma				Radon	(+/-)	
Sample#	Easting	Northing	Electret#	Days.	Micro R/h	IV	FV	CF	pCi/L	pCi/L	Sample Site Conditions
282	*516800*	*6957100*	SBM134	3.03	10.00	728	703	10.3670	0.10	0.1	Peat - near Lake
283	*516700*	*6956800*	SBM138	3.03	10.00	731	702	10.3713	0.22	0.1	Sandy Gravel
284	*516700*	*6956700*	SBM145	3.03	10.00	711	686	10.2941	0.10	0.1	Wet Sandy Gravel
285	*516700*	*6956600*	SBM165	3.03	10.00	708	670	10.2533	0.52	0.1	Cobbly Gravel
286	*516700*	*6956500*	SBM269	3.03	10.00	608	578	9.8411	0.30	0.1	Sandy Gravel
287	*516600*	*6956427*	SBL946	3.03	10.00	723	707	10.3649	-0.19	-0.1	Peat - besides small lake
288	*516600*	*6956500*	SBL957	3.02	10.00	738	710	10.4035	0.19	0.1	Fine Sand - Frostboil
289	*516600*	*6956600*	SBL979	3.02	10.00	721	690	10.3241	0.29	0.1	Gravel and Sand and Boulders
290	*516600*	*6956697*	SCA039	3.03	10.00	637	613	9.9785	0.09	0.1	Sandy Gravel - besides swamp
291	*516600*	*6956800*	SCA080	3.02	10.00	648	624	10.0257	0.09	0.1	Bouldery gravelly Till
292	*516500*	*6956800*	SCA144	3.02	10.00	727	586	10.1138	3.91	0.2	Gravelly Till
293	*516500*	*6956700*	SCA043	3.02	10.00	610	581	9.8519	0.27	0.1	Peat and Boulders
294	*516500*	*6956600*	SCA012	3.02	10.00	643	616	9.9978	0.19	0.1	Gravelly Sand
295	*516500*	*6956500*	SCA058	2.99	10.00	624	577	9.8733	0.89	0.1	Gravelly Sand
296	*516500*	*6956400*	SCA013	2.99	10.00	603	580	9.8347	0.08	0.1	Gravelly Sand
297	*516500*	*6956300*	SCA128	2.99	10.00	548	523	9.5943	0.17	0.1	Cobbly Gravel
298	*516400*	*6956300*	SCA034	2.99	10.00	521	495	9.4762	0.22	0.1	Fine Sand - Frostboil
299	*516400*	*6956400*	SCA025	2.99	10.00	669	644	10.1138	0.13	0.1	Peat and Boulders and Sand - swampy spot
300	*516400*	*6956533*	SCA066	2.99	10.00	719	488	9.8862	7.13	0.4	Sandy Gravel - north side of pond
301	*516400*	*6956600*	SBZ563	2.99	10.00	697	646	10.1781	0.98	0.1	Sandy Gravel
302	*516400*	*6956700*	SBZ438	2.98	10.00	708	680	10.2747	0.21	0.1	Bouldery, Gravelly Till
303	*516400*	*6956800*	SBZ574	2.98	10.00	653	623	10.0343	0.30	0.1	Gravelly Sand
304	*516200*	*6956800*	SBZ445	2.98	10.00	685	663	10.1889	0.02	0.1	Silty Gravel
305	*516200*	*6956700*	SBZ619	2.98	10.00	722	686	10.3177	0.47	0.1	Silty Gravel
306	*516200*	*6956600*	SBZ442	2.98	10.00	612	582	9.8583	0.32	0.1	Silty Gravel
307	*516200*	*6956500*	SBZ996	2.98	10.00	640	618	9.9957	0.04	0.1	Bouldery Cobbly Till
308	*516200*	*6956400*	SBZ617	2.98	10.00	667	648	10.1180	-0.07	-0.1	Gravelly Sand
309	*516200*	*6956300*	SBZ957	2.98	10.00	706	682	10.2747	0.08	0.1	Gravelly Cobbles
310	*515800*	*6956800*	SCA088	3.00	10.00	694	590	10.0515	2.75	0.2	Gravelly Sand Till
311	*515800*	*6956700*	SCA049	3.00	10.00	702	623	10.1395	1.90	0.1	Gravelly Sand Till
312	*515800*	*6956600*	SCA059	3.00	10.00	390	359	8.9031	0.46	0.1	Bouldery Till

Table-2
Typical sample set of results
Radon in Water

Sample	UTM		Electret				Gamma				Conversion	Radon in water
#	Northing	Easting	#	StartTest	Finish Test	Days	Micro R/h	IV	FV	CF	constant	pCi/L
Verification Test			SP4308	23/01/2001 11:00	26/01/2001 19:00	3.33	10.00	700	650	2.0842	73.9603	468.0
			SP4319	23/01/2001 11:00	25/01/2001 17:00	2.25	10.00	695	653	2.0836	67.5945	546.8
1W	516273	6957069	SCA014	31/07/2005 16:50	01/08/2005 17:00	1.01	10.00	756	540	2.0687	60.7230	6243.7
2W	516208	6957079	SCA024	01/08/2005 20:35	02/08/2005 21:45	1.05	10.00	735	233	1.9748	60.9458	14721.1
3W	Algae	Algae	SCA033	31/07/2005 16:50	01/08/2005 17:00	1.01	10.00	738	553	2.0673	60.7230	5343.8
4W	516258	6957071	SCA087	01/08/2005 20:35	02/08/2005 21:45	1.05	10.00	737	501	2.0521	60.9458	6631.0
5W	516050	6957084	SBM398	02/08/2005 20:45	03/08/2005 20:52	1.00	10.00	459	434	1.9534	60.7119	720.4
6W	516148	6957105	SCA033	02/08/2005 20:50	03/08/2005 20:55	1.00	10.00	551	482	1.9934	60.7045	2041.1
7W	516200	6959400	SBM228	03/08/2005 21:05	04/08/2005 21:02	1.00	10.00	689	680	2.0896	60.6748	209.1
8W	516400	6959770	SBM385	03/08/2005 21:05	04/08/2005 21:05	1.00	10.00	671	666	2.0804	60.6860	93.1

Figure 1
Location of Exploration

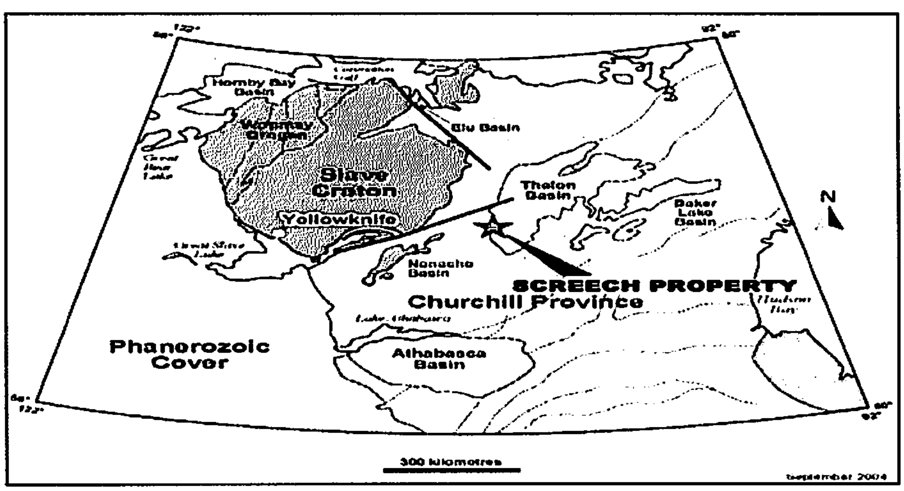

Figure 2
Portions of the results presented in contour format