Field and Laboratory Techniques Employed in the Surface Sampling Breccia Pipe Uranium Mineralization Resource Assessment Method Developed by DIR Exploration, Inc.

DIR Exploration, Inc.
3614 G 4/10 Road
Palisade, CO 81526
Contact person: Larry D. Turner
970-464-7236
ldturner@dirxploration.com

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Executive Summary

DIR has successfully researched, developed, and tested a geochemical technology that permits reasonably accurate pre-drilling estimation of the magnitude of uranium resources present in Arizona collapse breccia pipes by sampling and measuring the weak pipe-related mineralization in the rocks above and surrounding mineralized breccia pipes. The orientation study test cases used to research, develop, and calibrate the DIR method are the Hermit, Arizona-1, Pinenut, Kanab North, Orphan,[1] Pigeon, and Hacks 2 and 3 Mines. Data obtained from these known sub-economically to economically-mineralized breccia pipes permitted geostatistical estimation of a field sample- and mine production record-based calibration curve. This curve causally relates the strength and nature of the weak mineralization found at the surface of each of the mined breccia pipes to the amount of uranium mineralization known to exist in the subsurface, and yields an average uranium resource estimation error of less than 5%. The DIR breccia pipe uranium resource assessment procedure works well on both surface-penetrating and buried pipes. Aside from its use as an exploration tool, DIR is convinced that the accuracy, reliability, and validity of the method is sufficient to serve as an early, rapid, and low-impact method of privately validating breccia pipe lode mining claims located on northern Arizona federal lands administered by the BLM and USFS.

This report describes the field sampling and analytical lab techniques employed by DIR in the development and application of its new breccia pipe exploration technology. Following these sampling and analytical procedures on the index pipes named above will provide other breccia pipe exploration and mining companies with the same geochemical data set as that used by DIR to statistically estimate the unique mathematical equation that permits reasonably accurate estimation of uranium resource present in the individual breccia pipes of northern Arizona. In the event readers are unable to successfully reverse-engineer DIR's innovation using the same data that were available to DIR during its own methods development work, DIR is willing to provide individual companies non-exclusive licenses to the DIR breccia pipe exploration and claims validation technology. Alternatively, DIR would be interested in leasing the mining claims held by its competitors that are determined by DIR to contain a reasonable probability of containing sufficient uranium mineralization to be developed into paying uranium mines.

[1] Samples courtesy of the recent Grand Canyon National Park Service Orphan Mine surface clean-up effort.

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Introduction

The exploration methods research and development work partially described here was initiated in 2006 by DIR Exploration, Inc., in search for a cost-effective and rapid means of discriminating between fertile (potentially economically-mineralized) collapse breccia pipes and similar-looking barren (weakly- or non-mineralized) non-pipe geological structures[2] in northwestern Arizona. The historically primary target breccia pipe lode type is shown in Figure 1. This surface-penetrating category of breccia pipe extends from collapsed caverns in the Redwall Limestone all the way up through the Kaibab Limestone or younger formations, and usually contains down-dropped rock material from higher and younger rocks overlying the Kaibab Limestone. The physical characteristics of this type of pipe create, among other things, the simple magnetic and resistivity geophysical signatures described by Kwarteng (1988).

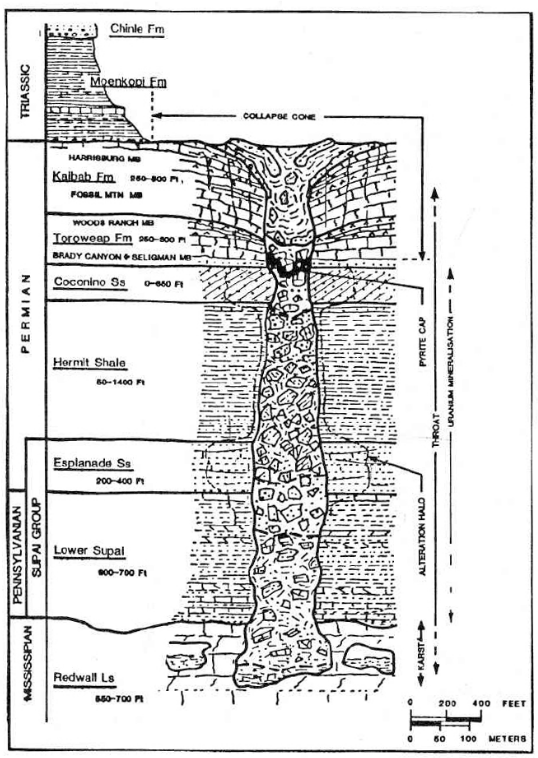

Figure 1. Diagram of a Surface-Penetrating Collapse Breccia Pipe. Taken from Figure 2 of Krewdl and Carisey, 1986.

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[2] As Wenrich (1992) explains, shallow evaporite dissolution and shallow karst processes led to the development of certain vertical structures that were not subject to mineralizing fluids. These shallow structures can sometimes be confused with the surface aspect of collapse breccia pipe lodes.

As breccia pipe exploration and uranium property acquisition has continued in Arizona, the hitherto easily detected and acquired surface-penetrating breccia pipe lodes of Figure 1 are progressively being replaced as exploration targets by Hacks 2 & 3-type hidden or buried lodes that have little or no surface structural expression.

Orientation surface sampling over collapse breccia pipes known to contain economic amounts of high quality uranium mineralization determined (DIR 2008) that the metals arsenic (As), cobalt (Co), copper (Cu), and molybdenum (Mo), most dependably exhibit markedly-anomalous values in rock chip samples taken from the surface rocks overlying and proximal to economically-mineralized breccias.[3] Each named metal is always co-precipitated with uranium in the uraninite and metal-sulfides mineralization present in Arizona's economically-mineralized breccia pipes. The direct, genetic relationship between the weak mineralization of pipes in pipe-overlying and pipe-surrounding surface rocks, and the stronger mineralization deeper in a given mineralized breccia pipe, is demonstrated by, among other things, the extremely close, mineralization depth-predictive mathematical relationship illustrated in Figure 2.[4] Graphically or mathematically taking into account the distance between the sampling surface and the shallowest major uranium accumulation for surface-penetrating mineralized breccia pipes shows that the metal values at the surface of such pipes are inversely related to the depth to mineralization. This follows the theoretically-expected result because the concentration of primary system[5] metal leakage into rocks proximal to ore bodies decreases regularly with increasing distance from ore (Rose et al., 1979, p. 103).

Note that the Hacks 2&3 buried or hidden pipe case does not fall on the statistically estimated line-of-best-fit in Figure 2. However, of the 5 cases shown on the graph, only Hacks 2&3 are not surface-penetrating breccia pipes. The upward stoping of Hacks 2, for example, is terminated in the lower Toroweap Formation, some 900 feet below the surface of the ground. The less developed infiltration and dispersion pathways between pipe mineralization and the top of the Kaibab Formation in buried pipe cases have evidently reduced the general level of mineralization-created metal leakage present in the rocks making up the sampling surface. Nevertheless, the metal leakage values measured at the surface of the

[3] From both sides of the Grand Canyon.

[4] The field sampling and geochemical lab methods later described in this report were used to generate Figure 2. The reader's field and lab duplication of this particular early work of DIR should provide tangible encouragement with regard to the efficacy of DIR's breccia pipe uranium resource estimation methodology.

[5] When speaking of the exploration geochemistry of ore bodies, the "primary system" refers to geochemical alteration of host and country rock that takes place <u>while</u> the ore body was being formed, while the "secondary system" refers to later geochemical alteration that takes place <u>after</u> the ore body is in place.

Hack 2 and 3 hidden pipes case are regionally-anomalous and are therefore significant.

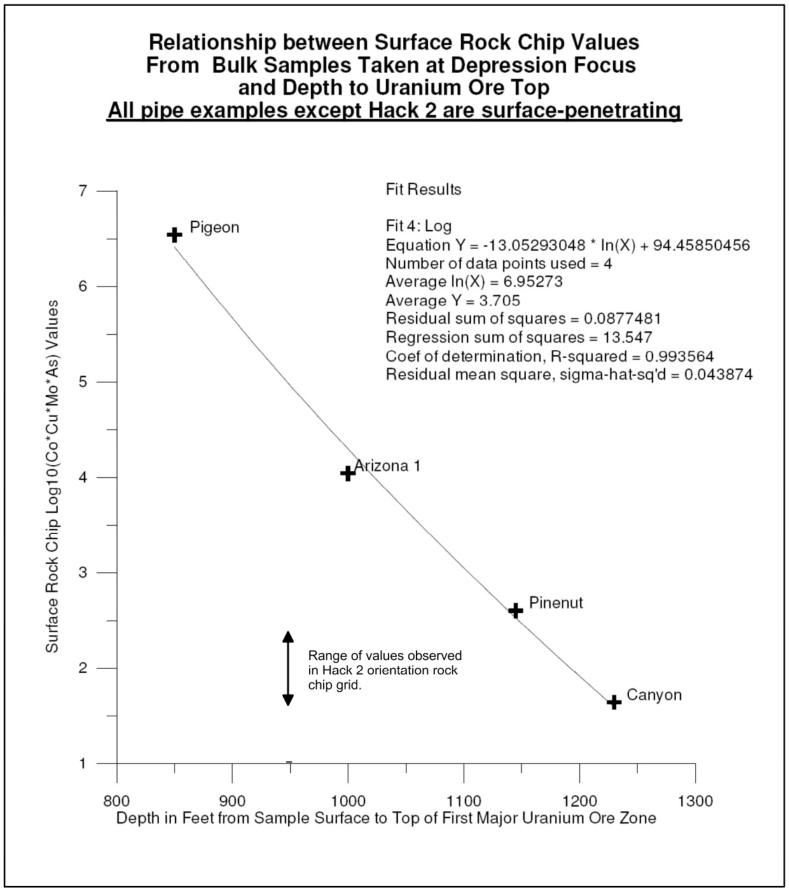

Figure 2. Graph illustrating the dilutional effect of depth to ore on strength of surface mineralization in economically mineralized collapse breccia pipes. Depth data are from Denison 2007. Surface rock chip data were obtained in 2006-2007 DIR sampling and contract laboratory analysis. Use of nested metal parameters like those shown on the Y-axis is explained in Beus and Grigorian, 1975.

Continuation of DIR's exploration methods research work in late 2009 and early 2010 extended the application of the company's earlier surface rock chip sampling and analytical geochemical work beyond the initial (1) discrimination of mineralized collapse breccia pipe lodes from unmineralized non-pipe structures, and (2) the estimation of depth to first (highest elevation) mineralization level in surface-penetrating breccia pipes. Recent computer statistical analysis of weak surface mineralization data obtained from economically-mineralized pipes has resulted in a practical, inexpensive, and low-impact technique for closely estimating magnitude of underlying uranium resource from sampling and measurements of the quantity and quality of weak surface mineralization. See Figure 3 and Table I. As Figure 3's inclusion of the Hacks 2 and 3 cases in the goodness-of-fit curve indicates, DIR's breccia pipe uranium resource assessment method works equally well for both surface-penetrating and buried pipes.

This successful exploration methods development work has ramifications not only for day-to-day and long-run breccia pipe uranium exploration program management and planning. It could also – considering certain critical tenets of US mining law defining the matters of discovery and lode mining claim validity – usefully minimize impact on the northern Arizona uranium mining industry of potentially arbitrary decision-making with regard to uranium exploration and mining activities in the Grand Canyon region. The following sections explain and describe the field and laboratory methods that generated the basic mineralization data employed in DIR's development of its new breccia pipe uranium resource estimation methodology.

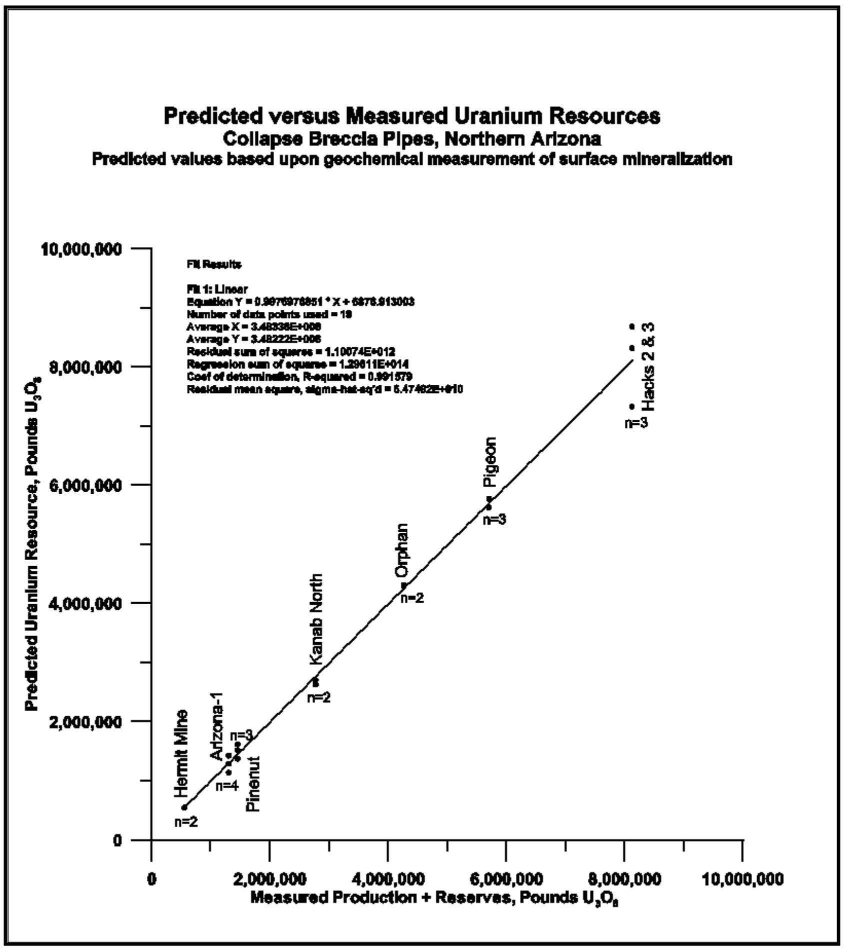

Figure 3. Comparison of DIR-method surface sampling uranium resource estimates with actual mine production and/or measured reserves.

Table I. Numerical Comparisons of Estimated and Measured Uranium Resource Values

Mined Ore Bodies	Actual Production + Defined. Reserves, lbs. U3O8	Predicted Resource lbs. U3O8	Absolute Relative Deviation in lbs. U3O8	Absolute Percent Deviation
Hermit-1	552,449	547,864	4,585	0.83%
Hermit-2	552,449	555,214	2,765	0.50%
AZ1JCRC	1,300,000	1,433,689	133,689	10.28%
AZ1-LT	1,300,000	1,295,900	4,100	0.32%
RE AZ1JCRC	1,300,000	1,143,261	156,739	12.06%
AZONE-ZH	1,300,000	1,295,852	4,148	0.32%
Pinenut1-JC-RC	1,450,000	1,526,565	76,565	5.28%
Pinenut2-JC-RC	1,450,000	1,379,141	70,859	4.89%
RE Pinenut2-JC-RC	1,450,000	1,621,384	171,384	11.82%
KN-2	2,767,570	2,633,411	134,159	4.85%
KN-1	2,767,570	2,713,867	53,703	1.94%
Orphan-JC-RC	4,260,000	4,320,703	60,703	1.42%
Orphan-ZH-RC	4,260,000	4,306,552	46,552	1.09%
Pigeon East Outer	5,702,570			
Pigeon West Outer	5,702,570			
Pigeon 1 avg.	5,702,570	5,635,802	66,768	1.17%
JC Pigeon Mine North	5,702,570			
JC Pigeon Mine South RC	5,702,570			
Pigeon 2 avg.	5,702,570	5,775,209	72,639	1.27%
Pigeon Inner RC (Pigeon 3)	5,702,570	5,629,108	73,462	1.29%
H2-2	8,122,021	8,687,227	565,206	6.96%
H2-1	8,122,021	7,336,911	785,110	9.67%
HACK 2 LT	8,122,021	8,324,434	202,413	2.49%
		Averages for All Pipes	**141,345**	**4.13%**

Sampling Method

Applying the surface rock chip sampling technique employed by DIR is the first step in determining whether or not any identified breccia pipe lode is reasonably likely to be sufficiently uranium-mineralized to merit further investment.[6] This sampling technique is rapid and simple to execute. For example, in its most recent two-week fieldwork period spent applying the DIR prospect assessment method, DIR was able to sample an average of seven separate breccia pipe prospects per geologist workday.

To complete the sampling phase of a breccia pipe resource evaluation, the geologist completes a single circuit around the circumference of the structural or geophysical target, taking a single quarter- to half dollar-sized rock chip as a

[6] That is, whether or not a discovery of valuable minerals has been made.

subsample at an interval varying from about 50 to 100 feet. In the cases of breccia pipes with clear surface expression, the rock chip sampling traverse is kept as close as possible to the structural focus of the feature.[7] Each such small rock chip is bagged with all other traverse chips to yield a single bagged sample. At small targets with clear surface expression, the chip sampling interval used is 50 feet, while at larger such targets the interval is extended to 100 feet in order to keep the total bulk rock chip sample down to a weight of about 2 pounds (1 kg). Figure 4 shows a typical sample traverse using the Canyon Mine breccia pipe as an example.

Note that the DIR surface chip sampling method is further standardized to the following important practice: Except for the avoidance of chert -- and caliche and associated pedogenic calcareous flowstone -- no sampling preference whatsoever is given to rock type or rock alteration as a chip sample medium. It is important for the purpose of maintaining the validity of this breccia pipe lode uranium resource assessment method that no well-meaning geologist-imposed sampling bias be introduced to the sampling procedure. In cases where no outcrop exists at the 50 or 100-foot chip sample interval being used, the traverse continues at multiples of the selected interval once rock outcrop is encountered again.

Lab Procedures

In the event the reader plans to eventually use a license of DIR's uranium resource estimation method, it is critical to employ the same contract analytical laboratory that DIR used in its definition of the northern Arizona uranium resource surface sample vs. uranium resource calibration curve. This step is important because of the slight analytical result-influencing variations in sample prep and sample analysis procedures that ordinarily exist among all chemical laboratories. All laboratory analyses for DIR in the development of the exploration method described in this report have been carried out by Acme Labs:

Acme Analytical Laboratories Ltd.
1020 Cordova St. East,
Vancouver, BC Canada V6A 4A3
Tel: (604) 253-3158
Toll Free: 1-800-990-2263
Fax: (604) 253-1716
E-mail: acmeinfo@acmelab.com

[7] Soil and sediment fill accumulated in the centers of most such breccia pipes frequently makes it only possible to obtain good rock chip material along traverses distal to the structural focus. According to the DIR field and lab results, this does not cause any particular difficulty in making breccia pipe uranium resource estimates. This lack of difficulty and DIR's surface rock chip grid work on several mineralized prospects show that the pipe-related weak mineralization envelope is very broad in extent.

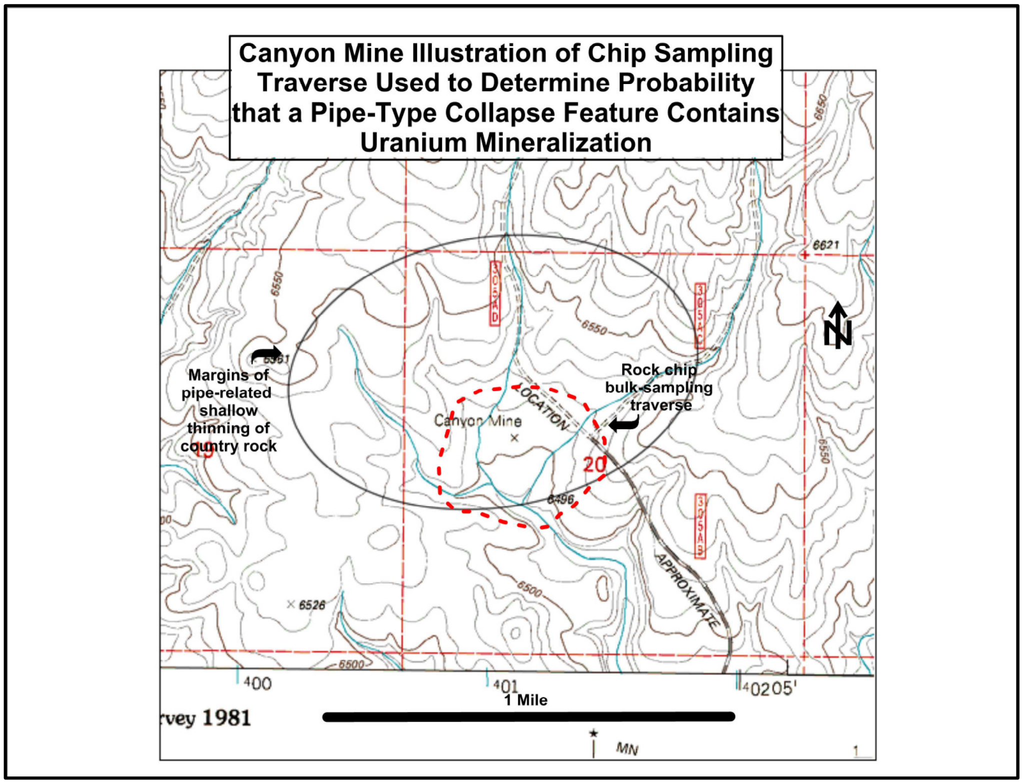

Figure 4. Example of a DIR-type surface bulk chip sample traverse, Canyon Mine, Coconino County, Arizona.

Sample preparation and analysis work carried at Acme consists of:

1. R200-250 prep code – crush whole 1 kg rock chip sample to 80% passing 10 mesh, split 250g and pulverize 85% passing 200 mesh;

2. Group 1DX1 analysis code -- digest 0.5g of –200 mesh pulp in 95C hot *aqua regia* and analyze for 36 elements[8] using ICP-MS.

Acme reports blank, standard, and replicated analyses along with sample analytical results, which provides one means for monitoring laboratory analytical quality. In addition, DIR submits a minimum 5-10% unidentified sample duplicates for further sampling and analytical quality control.

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[8] Mo, Cu, Pb, Zn,Ag, Ni, Co, Mn, Fe, As, U,Au, Th, Sr, Cd, Sb, Bi, V, Ca, P, La, Cr, Mg, Ba, Ti, B, Al, Na, K, W, Hg, Sc, Tl, S, Ga, & Se.

Rock samples are shipped UPS to Blaine, Washington, for pick-up there by Acme. Historical sample analysis turn-around times are 3-4 weeks from date of sample shipment to Blaine, Washington. For further information, see the Acme price brochure available online at http://acmelab.com/pdfs/Acme_Price_Brochure.pdf.

Sampling and Analysis Timing

As explained by the US Geological Survey in its two papers describing the ramifications of a similar technique (see below), the DIR pre-drilling northern Arizona breccia pipe uranium resource estimation method makes it possible to rationally prioritize ordinary exploration expenditures among various available prospects. In addition to this application, the method appears capable of validating mining claims by establishing the fact of discovery under the US Mining Law. If employed for this purpose under the current conditions of threat of a long-term (20 year) federal mineral lands withdrawal, it will be necessary to complete sampling and analyses supporting discovery documentation *before* the event of a federal withdrawal decision.[9]

In further support of claims validation work using DIR's innovation, it is recommended that anyone employing the DIR methodology record and store GPS-tracking for each individual prospect sampling traverse, and also document the dates of prospect sampling and chemical analyses of samples taken from each prospect.

Conclusion

Following these sampling and analytical procedures on the index uranium mines first referenced above will provide the reader with the same geochemical data set as that used by DIR to statistically estimate the unique mathematical equation relating surface mineralization to subsurface breccia pipe mineralization. This equation is based on established geochemical theory of uranium ore body epigenesis and permits reasonably accurate *pre-drilling* estimation of uranium resource present in the individual breccia pipes of northern Arizona.

Note that an early approach to the same general exploration methods development problem addressed by DIR has been described by the US Geological Survey in two separate reports (1959, 1960) which can be downloaded from:

http://pubs.er.usgs.gov/djvu/B/bull_1112_b.djvu, and
http://pubs.er.usgs.gov/djvu/TEI/teir_511.djvu

[9] This Department of Interior decision is now expected to take place in July 2011.

Review of these reports may provide the reader with some general insights as how to go about independently reproducing DIR's uranium resource estimation methods development work.

In the event the reader is unable to successfully reverse-engineer DIR's innovation using the data that were available to DIR during its own methods development work, DIR is willing to provide individual companies non-exclusive licenses to the full DIR breccia pipe exploration and claims validation technology. Alternatively, DIR would be interested in leasing the mining claims held by its competitors that are determined by DIR to contain a reasonable probability of containing sufficient uranium mineralization to be developed into paying uranium mines.

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