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REPORT
ON
QUARTZ MINERAL EXPLORATION PERMITS
No. 109 and No. 110
IN
NORTH EASTERN ALBERTA

PREPARED FOR
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ABCON ENGINEERING (ALBERTA) LTD.,
REPORT
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EXHIBITS:

Exhibit No. 1

Plan showing Quartz Mineral Exploration Permit No. 109
Scale 1" = 1 mile.

Exhibit No. 2

Plan showing Quartz Mineral Exploration Permit No. 110
Scale 1" = 1 mile.

ATTACHMENTS:

Drawing No. L.M.L. 69-01
Continental Location Map, showing Quartz Mineral Exploration Permits No. 109 and 110.
Scale 1" = 75 miles.

Drawing No. L.M.L. 69 - 02
Provincial Location Map, showing Quartz Mineral Exploration Permits No. 109 and 110
Scale 1" = 35 miles.

Drawing No. L.M.L. 69 - 03
Topographic Map, showing Quartz Mineral Exploration Permits No. 109 and 110
Scale 1" = 12 miles

Drawing No. L.M.L. 69 - 04
Geological Map, showing Quartz Mineral Exploration Permits No. 109 and 110
Scale 1" = 16 miles.
REPORT
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INTRODUCTION:

This report is a preliminary appraisal of the potential of the Quartz Mineral Exploration Permits No. 109 and 110 held by Ledo Mines Limited. The lands are in reservation status and were acquired from the Alberta Government - Department of Mines and Minerals.

This report does not go into details with respect to the geology of the area but discusses the potential of the permit area from the standpoint of comparison with what is required to form an economic uranium deposit with that of what may be expected within the permit area.

GENERAL INFORMATION:

Ledo Mines Limited acquired Quartz Mineral Exploration Permits No. 109 and No. 110 from the Province of Alberta Department of Mines on December 20th, 1968.

Quartz Mineral Exploration Permit No. 109 is located in Township 102, Ranges 1 and 2, W. 4 Meridian and consists of 19,840 acres of mineral rights. (See Exhibit No. 1)

Quartz Mineral Exploration Permit No. 110 is located in Township 105 and 106, Range 5, W. 4 Meridian and consists of 19,840 acres of mineral rights. (See Exhibit No. 2)
GENERAL DISCUSSION OF URANIUM MINERALS

There are only a few uranium minerals which are economically attractive for mining and could thus be classified as uranium ores. Pitchblend and uranite theoretically contain 85% uranium but due to impurities, contain usually between 50% and 80%. Carnotile, torlurnite, tyuyamunite, autunite, uranophone and coniute 45 to 60%. In other minerals, uranium is an important but relatively minor constituent, as examples, the minerals davidite, samarskite and eunanite contain only 1 to 18%. The majority of the uranium bearing minerals contain uranium in small or trace amounts as an accessory to other major constituents.

The uranium content itself, however, does not determine whether it is a uranium ore mineral but a combination of the complicity of the mineral and percentage content. Economics of mining uranium are also dependant on the market and value of uranium from time to time. New extraction processes do of course, influence the economics of extracting uranium from a mineral. Most of the uranium in pegmatite and placers are refractory and extremely difficult to break down chemically. These minerals are also usually scattered unevenly throughout the deposit so that although the mineral may contain 50% uranium, the average content is much lower.

Only a few of the numerous uranium minerals qualify as a uranium ore mineral whereas uranium in small amounts is widely spread throughout the rocks of the earth’s crust.

A brief description of the various uranium ore minerals is given below in order that an evaluation of the areas of the permits may be made.

PRIMARY URANIUM ORE MINERALS

Primary uranium minerals occur most commonly in veins or pegmatites, although in recent years flat lying deposits of pitchblende in sedimentary
rocks have also been discovered.

**URANITE:** is combined UO₂ and UO₃, 50%-85% U₃O₈ and is a naturally occurring uranium oxide. It's most widespread occurrence is in pegmatites in which it is found in small amounts throughout the world. However, it is an important constituent of all primary deposits occurring in its massive variety - pitchblende. Uranite is not a refractory mineral and should not be confused with the many complex uranium minerals found in pegmatites. Uranite sometimes occurs as finely divided crystals within the host rock.

**PITCHBLENDE:** is the massive variety ofuranite. It is without apparent crystal form and occurs most abundantly in the rich vein deposits of uranium. Pitchblende accounts for the majority of uranium production in the world.

Pitchblende is commonly associated with one or more of the primary ore minerals of iron, copper, cobalt, lead, silver and bismuth and the presence of these minerals is one indication for favourable conditions for deposition of pitchblende. Pitchblende is likely to be deposited in existing open spaces in rock formations rather than replacement of the rock. There are no imported replacement deposits as there are in other minerals.

Pitchblende has also been discovered in Sandstone and conglomerite where it has filled the spaces around the grains of rock.

**DAVIDITE:** is made up of rare earth-iron-tetronium oxide 7-10% U₃O₈. It occurs commonly in angular, irregular masses, sometimes with drystal outlines, but not in round leotryoidal shapes like pitchblende. Davidite is deposited in hydrothermal veins, presumably at higher temperatures and pressures than pitchblende. DAVIDITE is almost never found as the 'pure' mineral but rather in complex intergrowths with ilmenite which has very similar physical properties and chemical composition.
SECONDARY URANIUM ORE MINERALS

The secondary uranium ore minerals have represented only a small portion of the total world uranium production. Their deposits are, however, more numerous and as a result of intensive exploration activity, their importance is increasing. The secondary minerals have three major modes of occurrence:

(a) In the weathered or oxidized zones of primary deposits where they are formed by decomposition of the primary mineral in plan.

(b) As irregular, flat lying deposits in sedimentary rocks, primarily sandstones, but also conglomerates, shales and limestones formed by precipitation from solutions that may have carried the uranium some distance from the original source.

(c) Along with a large variety of other secondary uranium minerals, mainly the uranium phosphates, carbonates, sulphates, hydrous oxides and silicates. These may be referred to as oxidized deposits.

The flat lying deposits in sedimentary rocks represent the most important occurrences of secondary minerals.

Seventy-five percent of the more than one hundred uranium minerals are secondary minerals but of these only six may be considered ore minerals. Most of the others, occur primarily as the weathering products in the oxidized zones of primary deposits.

CARNOTITE: is a potassium uranium vanadate containing 50-55% U₃O₈ and is the most important of the secondary uranium ore minerals. Deposits of this mineral have provided possibly 90% of the uranium from secondary deposits. It occurs in sandstones in flat lying, irregular, partially bedded ore bodies in sizes ranging from a few tons to a hundred thousand tons. In the higher grade deposits, containing more than 1% U₃O₈, the carnotite is present in sufficient quantity to colour the rock a bright yellow. But in poorer deposits it is often difficult to distinguish from the sandstone host rock.

Nearly twenty other secondary uranium minerals are found associated with carnotite. The most common non-uranium minerals found associated with
carnotite the most common being the various types of vanadium minerals.

Carnotite has also been noted to have an affinity for certain organic materials which has had some effect on its accumulation in almost all types of deposits. In a large number of carnotite deposits, the deposition is associated with silicofied or carbonized wood and a variety of coal like and asphaltic materials.

**Tyuyamunite:** is the same chemical structure as carnotite except calcium has been substituted for potassium. Tyuyamunite is found in small amounts in all carnotite deposits with its presence increasing in amounts near a source of calcium.

**Torbernite:** is a lydrous copper uranium phosphate containing 60% U₃ O₈. Torbernite is the most common of the secondary uranium minerals that are found in association with primary deposits where oxidation has occurred. It is common in nearly all such deposits except pegmatites which usually do not contain the necessary copper to form it.

**Outunite:** has the same chemical composition as torbernite but with calcium substituted for copper. It is commonly found in association with torbernite and the relative quantities dependant on the amount of copper available to the parent solutions. Outunite is found in varying amounts in almost all the other secondary uranium minerals. It is an oxidation product of pitchblende and uraninite and most of the other primary minerals.

**Uranophone:** is a hydrated calcium uranium silicate containing silica in place of the phosphate of outunite and contains about 65% U₃ O₈. It may occur as stains or coatings without apparent crystal form or as finely fibrous or radiating crystal aggregates.

**Schroeckingerite:** is a complex hydrated sulfate, carbonate, and fluoride of calcium, sodium and uranium containing about 30% U₃ O₈. It is very soft and
easily soluble in water. It occurs as globular coatings on rock fracture surfaces or as small rounded masses composed of aggregates of flaky crystals distributed through soft rocks or soil. It is the least important of the uranium minerals, and is rarely a significant constituent in the secondary ores of uranium.

RELEVANCE OF THE TYPICAL URANIUM MINERALIZATION TO THE PERMIT AREAS

From the preceding discussion it is evident that the prospector should concentrate firstly on primary mineral uranium ore deposits as these deposits offer the best opportunity for establishing an economic reserve, and, secondly on the secondary mineral uranium ore deposits where the extraction of other minerals in conjunction with uranium may make an economic mining operation.

POSSIBILITY OF DISCOVERING PRIMARY URANIUM MINERAL ORE DEPOSIT IN THE PERMIT AREAS

Nearly all primary deposits are formed in the voids or open spaces caused by faults or at the intersection of faults. A highly faulted area is therefore the most likely place to find a primary deposit. Very little, if any, geological data is present within the areas of the two permits, however, it is expected that faulting is not as prevalent as it is farther east on trend with Lake Athabaska.

The Uranium occurrences reported to date in the immediate area of the subject permits have occurred within the geological formation known as the Athabaska Sandstone. The permits are plotted on the attached map No. L.M.L. 69-04 and do not occur within this formation area on the map.

Thus the possibility of radium occurrences in the subject permits is very doubtful.

It is therefore not considered a prime area for uranium exploration. The possibility does exist however, that a primary deposit of uranium mineral ore exists within the pososity of sandstone lenses. This type of deposit is nevertheless relatively rare in nature and such a deposit cannot reasonably be expected within the permit areas.
POSSIBILITY OF DISCOVERING A SECONDARY URANIUM MINERAL ORE DEPOSIT IN THE PERMIT AREAS.

The economics of secondary uranium mineral ore deposits are usually associated with the economics of extracting other minerals along with uranium. Although such mineralization is far from rare, the number of locations where such deposits form an economically mineable ore body are few in number and such a prospect does not appear to provide any incentive to institute an extensive exploration program in the permit areas.

EFFECT OF THE MARKET ON THE VALUE OF URANIUM DEPOSITS.

As in any other commodity, the price received is a prime consideration in the investment of funds for exploration and development.

An over-riding consideration, however, is that rich deposits of any mineral ore often worth retaining is speculation of the market values increasing.

The permits under review, however, do not appear to warrant retention on the prospect of a change in market values and further do not appear to warrant a detailed exploration program.

CONCLUSION:

1. The permit areas do not appear to be well situated for the occurrence of an economically mineable uranium deposit.

2. The possibility of other minerals being present to enhance the economics of a secondary uranium deposit are rare in nature and not considered a likely possibility here.
RECOMMENDATIONS:

In view of the information submitted above the following recommendations are in order:

1. It is recommended that no further effort be expended in evaluating the subject permit areas.

2. Quartz Mineral Permit No. 109 and No. 110 should be surrendered immediately.
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Bulletin 68
QUARTZ MINERAL EXPLORATION PERMIT No. 109

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