Lithium and Beryllium By-product Recovery from the Round Top Mountain, Texas, Peraluminous Rhyolite Heavy Rare Earth Deposit

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Rationale
The technology metals Li and Be combine low mass and unique desirable electronic properties. Li batteries are critical in applications at scales from micro-electronics to automotive and grid storage. Most Li is sourced from desert salars in the "Lithium Triangle" of Argentina—Bolivia—Chile. Low mass Be structural components are essential in aerospace/defense applications and in non-sparking BeCu alloy oilfield and industrial tools for use in ignitable atmospheres. In contrast to Li, Matierion Corporation mines >90% of global Be at the aging Spor Mountain, Utah deposit.

Li and Be at Round Top Mountain
The massive peraluminous rhyolite heavy rare earth deposit at Round Top Mountain, TX is also enriched in Li, 508 ppm, and Be, 50 ppm. 2016 prices of $7000/tonne Li2CO3 (35 tonnes Li) and $1000/kg Be metal suggest favorable economics to extract Li and Be as by-products of heavy rare earth element mining (HREE). Li and some Be are hosted in anate biotite that comprises up to 5% of the rhyolite. Texas Mineral Resources Corp. proposes to heap leach crushed rhyolite with dilute H2SO4 to release the yttriothoite-hosted HREEs. At bench scale the anate biotite dissolves (as do yttrofluorite, cryolite, magnetite, hematite and other minor phases) but not the quartz and biotite dissolves (as do yttrofluorite, cryolite, magnetite, hematite and other minor phases) but not the quartz. Successive plots exhibit elements at lower concentrations.

Be extraction from bulk country rock.

Leach Technique & Results
A series of 40 high-yield laboratory bench scale leach tests at various acid strengths, particle sizes, and exposure times released up to 350 ppm (70%) of the Li and 14 ppm (38%) of the Be. For a 20,000 tonne/day operation, these recoveries correspond to optimal daily production of >7 tonnes Li (35 tonnes Li2CO3) and 250 kg Be. Higher Li and Be recoveries also increased yields of gangue elements, principally Fe and Al, into solution. This complicates subsequent separation of Li, Be, and HREEs from the pregnant leach solution (PLS). Recovery of target YHREEs did not increase beyond conditions yielding ~200 ppm Li and 8 ppm Be recovery. Higher Li and Be recoveries also increased acid consumption. Thus the "sweet spot" economics for a heap leach is likely under conditions of acid strength, grain size, and exposure time that do not maximize by-product Li and Be recoveries.

Evolving market prices for the full target element suite complicates subsequent separation of Li, Be, and HREEs from the PLS. Recovery of target YHREEs did not increase beyond conditions yielding ~200 ppm Li and 8 ppm Be recovery. Higher Li and Be recoveries also increased acid consumption. Thus the "sweet spot" economics for a heap leach is likely under conditions of acid strength, grain size, and exposure time that do not maximize by-product Li and Be recoveries. Evolving market prices for the full target element suite and added costs to recover the Li and Be from the PLS and purify them must also be considered.

Be mineralization zone at rhyolite-carbonate country rock contact. 100,000 tonnes at 2% BeO. Photos of 300 m shaft from earlier study. Zone is distinct from Be extraction from bulk rhyolite in the deposit.

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