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# Micro-distribution of heavy rare earth elements in Round Top Mountain rhyolite deposit (Hudspeth County, Texas, USA) by EPMA mapping


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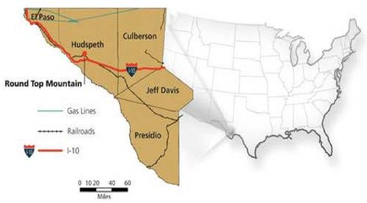
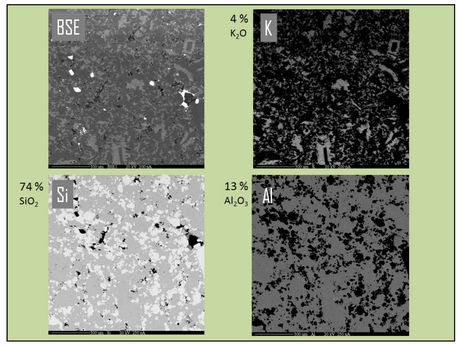
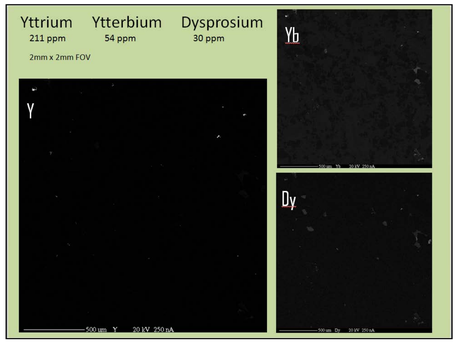
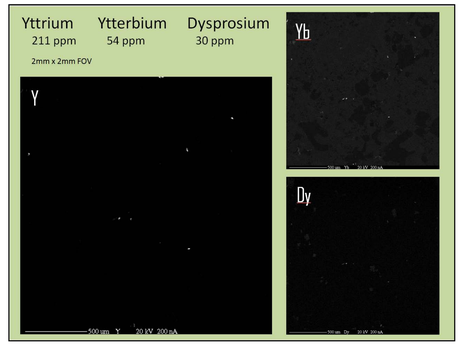
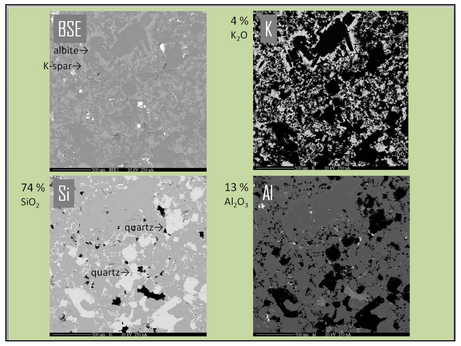


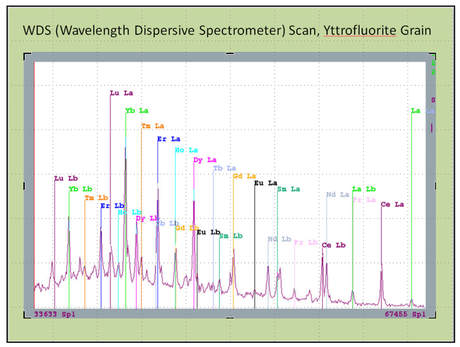



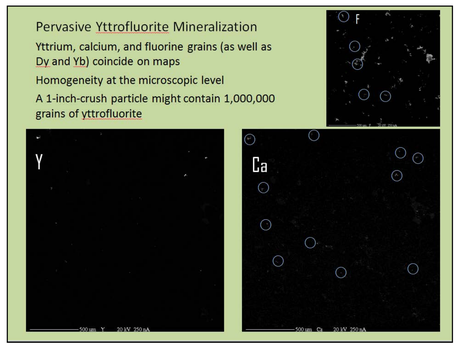




Round Top Mountain, virtually all of which is mineralized rhyolite



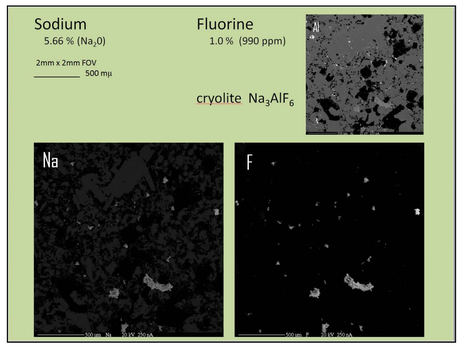



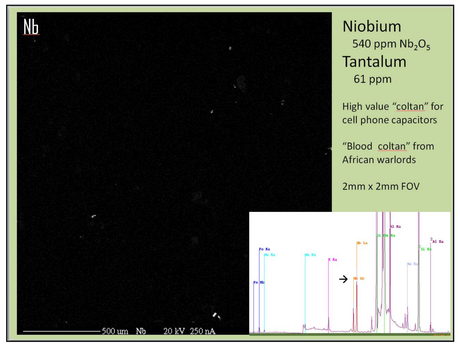




## BACKGROUND

**Round Top Mountain is a surface-exposed peraluminous rhyolite laccolith, enriched in heavy rare earth elements, as well as niobium-tantalum, beryllium, lithium, fluorine, tin, rubidium, thorium, and uranium. The extreme extent of the deposit (diameter one mile) makes it a target for recovery of valuable yttrium and HREEs, and possibly other scarce elements. The Texas Bureau of Economic Geology estimated the laccolith mass as at least 1.6 billion tons. A Preliminary Economic Assessment for Texas Rare Earth Resources listed an inferred mineral resource of 430,598,000 kg REOs (rare earth oxides), with over 70% Y+HREEs (YHREE). Put in global perspective, China is thought to produce ~25,000 tons YHREE per year, and exports but a small fraction of that.**

**The grade of the deposit is just over 0.05% total rare earth elements plus yttrium. Although some might consider this sub-economic, it is in the range of the South China ionic clay deposits that supply essentially all of the world's YHREEs. Further, the grade is remarkably consistent through 1657 samples from 64 reverse-circulation drill holes with a total sampled interval of 30,353 feet. This consistency of grade permits accurate economic assessment and prediction, an unchanging ore grade and mine feedstock over life of mine, and a single REE separation chemistry to be developed. Thus mine and separation procedures need only be developed and optimized once.**




## A million yttrofluorite grains are in a 1-inch crush particle

- 2 mm x 2 mm microprobe map has 10 visible yttrofluorite grains
- Estimate 2 grains per mm²
- Conservative estimate that microprobe penetrates 10 µm
- Every 10 µm layer in a 1 mm cube has 2 grains, so 200 grains per mm³
- 1-inch cube contains about 8,000 mm³
  - 25 mm x 25 mm x 25mm = 16,000 cubic mm. Sphere contains about ½ the volume of an enclosing cube
- 200 x 8,000 = 1.6 million yttrofluorite grains, *mirabile dictu!*

## Findings & Significance

**Texas Rare Earth Resources proposes to heap leach the rhyolite with dilute sulfuric acid to recover the REEs and U, Li, & Be byproducts. Crush size would be a nominal 1 to 1.5 inches.**

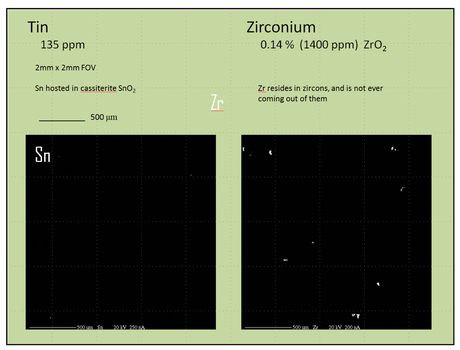
**These EPMA maps reveal:**

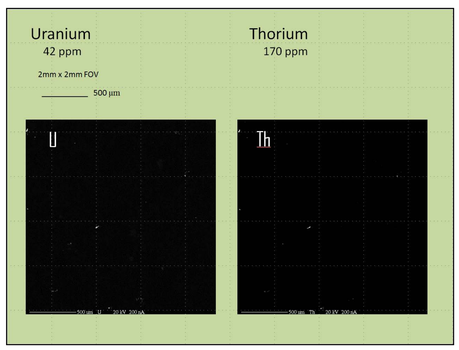
1. **the micron-scale grain size of the HREE host mineral, yttrofluorite.**
2. **The random, pervasive distribution of the yttrofluorite at sub-mm scale.**

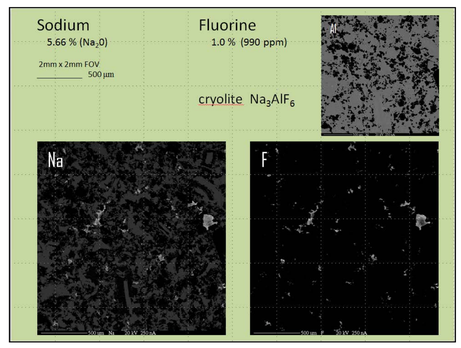
**Thus the homogenous macro-distribution of mineralization is also reflected at microscopic scale. Further, the difficulty or impossibility of REE recovery by such means of mechanical separation as gravity or flotation becomes apparent.**

## Earlier Macro-Scale Data:

**Feldspars & quartz comprise 90-95% of the rhyolite, with pheonocrysts of up to 250 microns set in an aphanitic matrix that hosts the micron-sized target yttrofluorite. Reverse circulation cuttings from >100 drill holes, & 2 drill cores suggest striking physical homogeneity through this billion-plus tonne surface exposed laccolith, ~1200 feet high & a mile in diameter (375 x 1600 m). Gray to pink color variation due to magnetite—hematite redox reaction. Plots of Y, 13 REEs, U, Th, & Nb analyses from >1500 samples collected from 64 drill holes exhibit remarkably little variation in concentration with geographic position or depth within the laccolith.**

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**HREE and Y average concentrations in Round Top Mountain rhyolite**

| YHREE | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| g/t (ppm) | 0.2 | 10.6 | 3.6 | 31.7 | 8.0 | 32.8 | 7.1 | 56.5 | 8.9 | 221 |


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