

Prospecting for Lithium in Pegmatites

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Background

Oxford County, Maine has large deposits of Lithium Bearing Pegmatites. Pegmatites are a type of rock with crystals over 1 cm. In this case the crystals contain spodumene. The mineral spodumene is important due to its lithium content.

For this project, we procured samples of pegmatite from Black Mountain Quarry, Rumford, ME to estimate the lithium content of deposits in the East Andover region.

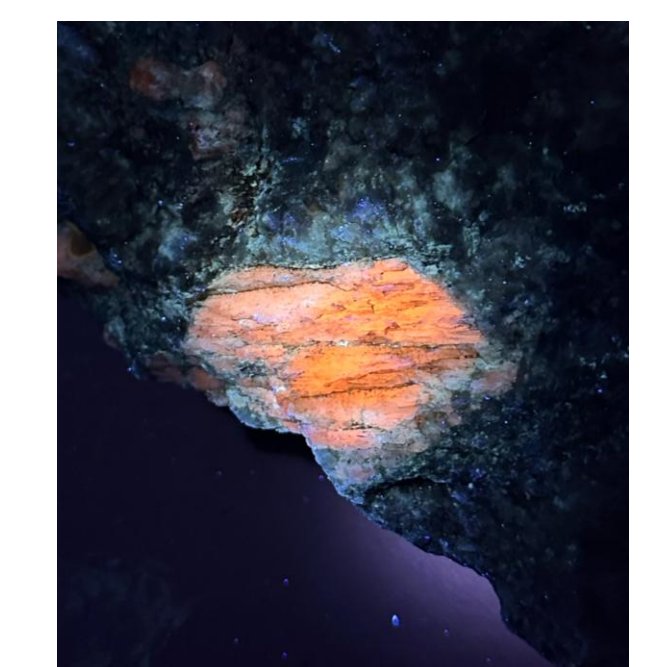


Figure 3. Spodumene glows orange/red under UV light



Figure 4. Pegmatite specimen

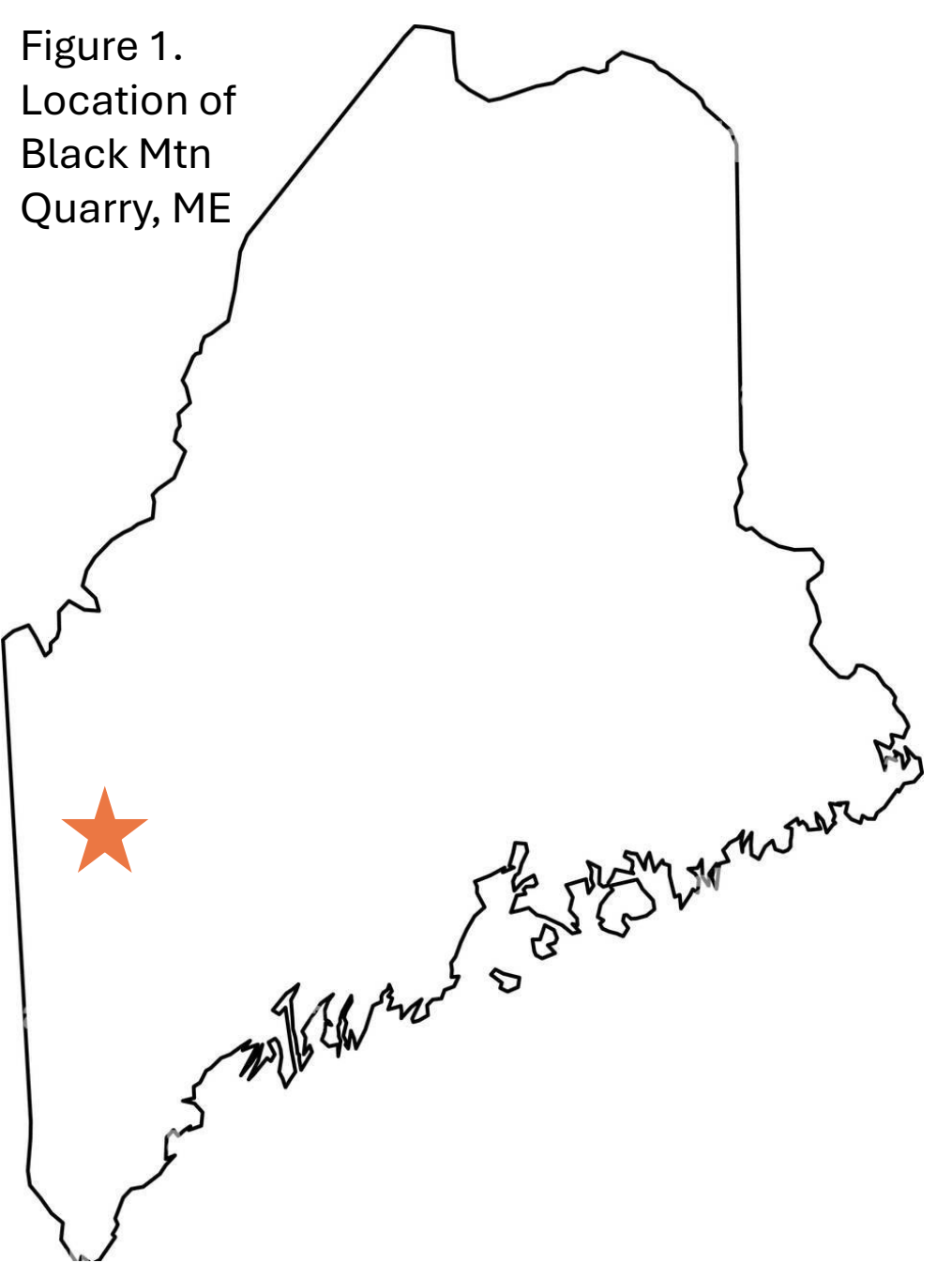


Figure 1. Location of Black Mtn Quarry, ME

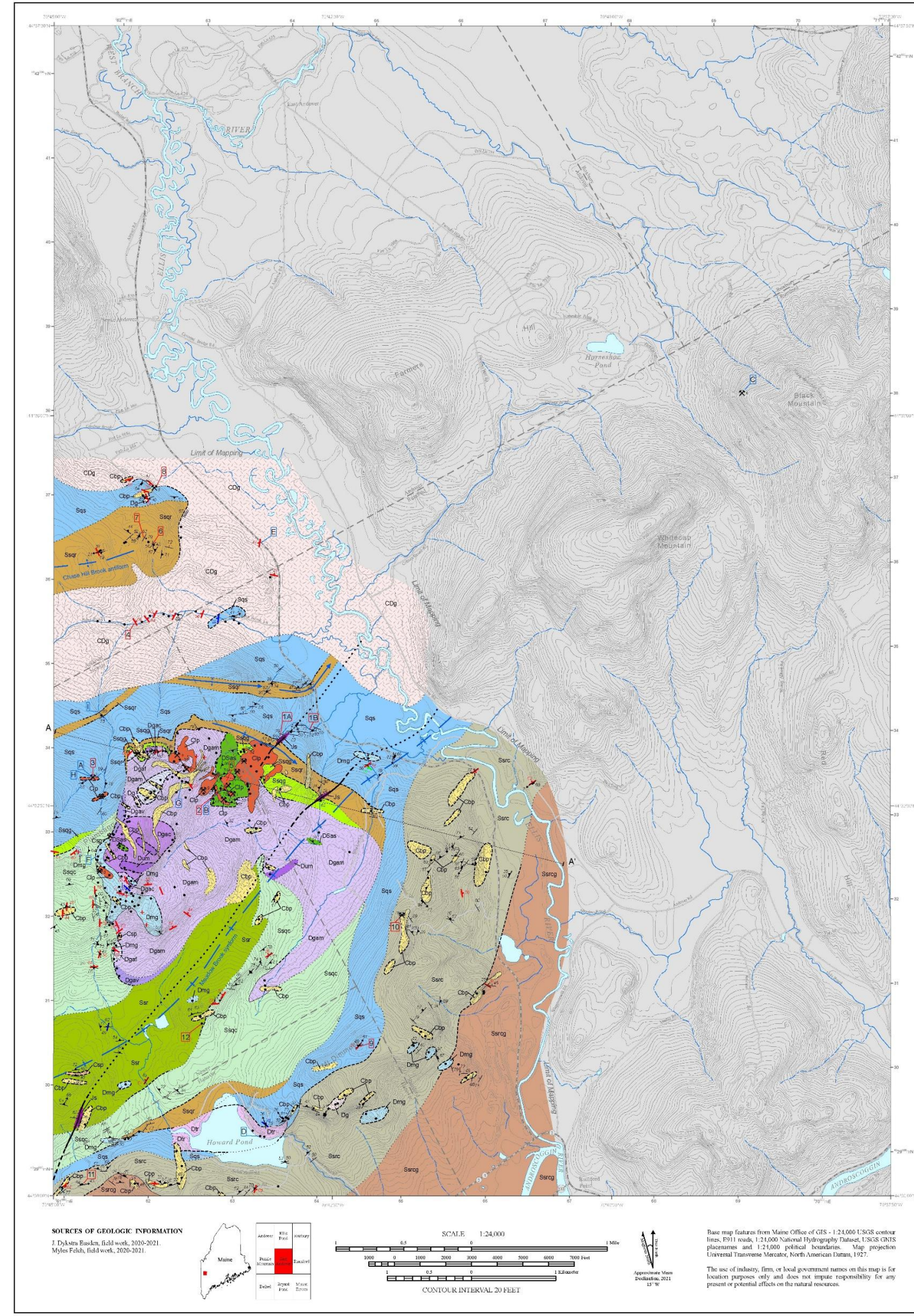


Figure 2. Geological map of East Andover, ME. The red deposits represent Lithium Bearing pegmatite.

Goal:

Find the percent by mass of spodumene in pegmatite samples to represent mineral contents in Oxford County.

Hammer and chisel:

Used a hammer and chisel to break the samples down to fist-sized chunks.

Jaw Crusher:

Crushed the pieces to sizes smaller than half of an inch.

Splitter:

Mixed the pieces to get a representative sample.

Disk mill:

Two plates grind the pieces to a gritty sand texture. Then used a sieve to get particles that are about 125-500 microns in size.

Methods



Figure 5. Using hammer and chisel to break down initial sample.

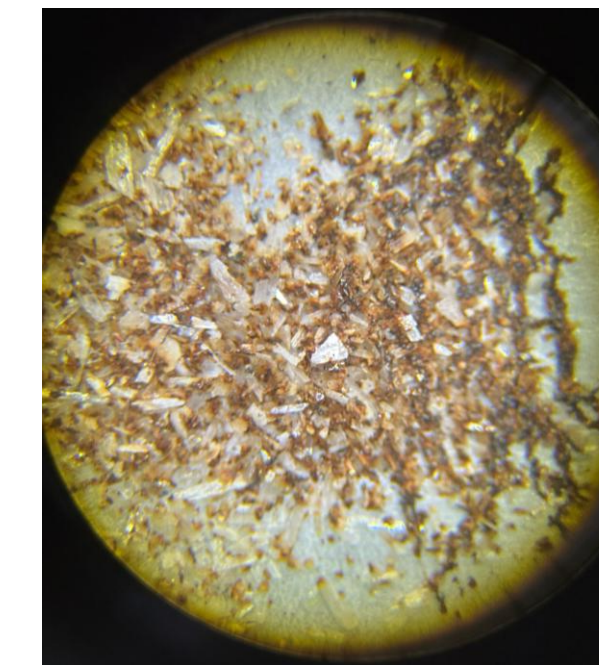


Figure 6. Microscope view of schorl from magnet with few spodumene crystals (white flakes)

Cleaning samples:

We then used distilled water and a sonicator to clear any particulate that would clog the next step.



Figure 8. Sonicator vibrates the minerals in water, suspending fine particles.

Heavy liquid separation:

Used lithium heteropolytungstate (LST) to separate minerals by density. Spodumene was densest.



Figure 7. Heavy Liquid Separation

Magnetic separation:

A neodymium magnet drew out any residual black schorl from the spodumene.

Results

	Sample 1 (A-1)	Sample 2 (C-3)	Sample 3 (E-5)
Mass of sample	37.76 g	30.37 g	39.00 g
Mass of spodumene	17.82 g	6.93 g	4.34 g
Spodumene wt%	47.19 %	22.82 %	11.13 %

Spodumene samples after Heavy Liquid Separation

Average Spodumene wt%	Mass of pegmatite deposit	Mass of spodumene	Mass of Li ₂ O	Estimated value (USD)
27.05%	2.34x10 ¹⁰ kg	6.34x10 ⁹ kg	2.67x10 ⁸ kg	1.08x 10 ¹⁰

Using Google Earth and the above map we could estimate the mass of all deposits. Then multiplying this by Spodumene mass by percent, we found the total mass of spodumene present. Using the current price of this purity of spodumene to be about 1,700 USD/Tonne we found the approximate worth of this deposit.

Application

Spodumene yields lithium, used in glassmaking, ceramics and batteries. A shift towards sustainable energy has put lithium batteries in high demand. They are crucial to advancing technologies like renewable energy and electric vehicles. If mining operations were to go forward, processing for lithium extraction would not occur in the state. However, the mining itself can reveal heavy metals like arsenic contained in other minerals such as granite or mica schist, that may affect surface water. Mining can also contribute to sediment runoff and habitat fragmentation in the area. However, mining is unlikely due to Maine's Metallic Mineral Mining Act, which limits mining of metallic materials such as zinc and copper. Spodumene forms in different ways than these and cannot pose acid mine drainage threats as these may.

Conclusion

Though our research we found there to be about 6.34x10⁹kg of spodumene. In this, there is roughly 2.67x10⁸ kg of Li₂O present. The current value of the spodumene is about 10.8 billion USD. As lithium is vital in energy sources, as well as contributing to the cleaner production of other materials like glass and ceramic, the demand for it has increased. For renewable energy to progress, lithium must be involved. However, mining of LI-bearing pegmatite may lead to an increase in heavy metals in surface water, habitat fragmentation and sediment erosion. Overall, Maine has vast amounts of pegmatite, especially in Oxford County. The lithium produced by potential mining could both pose environmental impacts and greatly contribute to the advancement of modern technologies, as seen in the rich deposits of the region.

Acknowledgments

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