

Geochemistry of the U-Th-REE mineralized Tajo granite, Socorro County, New Mexico

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Abstract

The Proterozoic Tajo granite consists of six outliers along two northwest-trending faults east of Socorro. The area was originally examined for uranium, but fluorite and rare earth elements (REE) were reported as well. REE consist of the 15 lanthanide elements and includes scandium and yttrium. While common in the crust, REEs do not often occur in economically viable amounts, and are fundamental to a wide variety of technologies including electric cars, energy-efficient lights, and smart devices. Considering America's heavy reliance on other countries for REE supplies, identifying, analyzing, and categorizing potential REE deposits could serve as a considerable independent, economic, and strategic interest. Some Proterozoic granites, including the Tajo granite in New Mexico, contain uranium and REE, but their economic resource potential is unknown. Preliminary petrographic and geochemical analyses of the Tajo granite indicate that it is medium-to coarse-grained, peraluminous granite, but is relatively low in REE and uranium. Geochemical comparisons of the Tajo granite to other granites found in New Mexico show that Tajo has an unusual composition. It is enriched in Rb, U and Th compared to most Proterozoic granites, and depleted in CaO, Na₂O, and Sr. Future studies need to further analyze petrographic and geochemical samples to determine what depleted the REE and characterize petrogenesis.

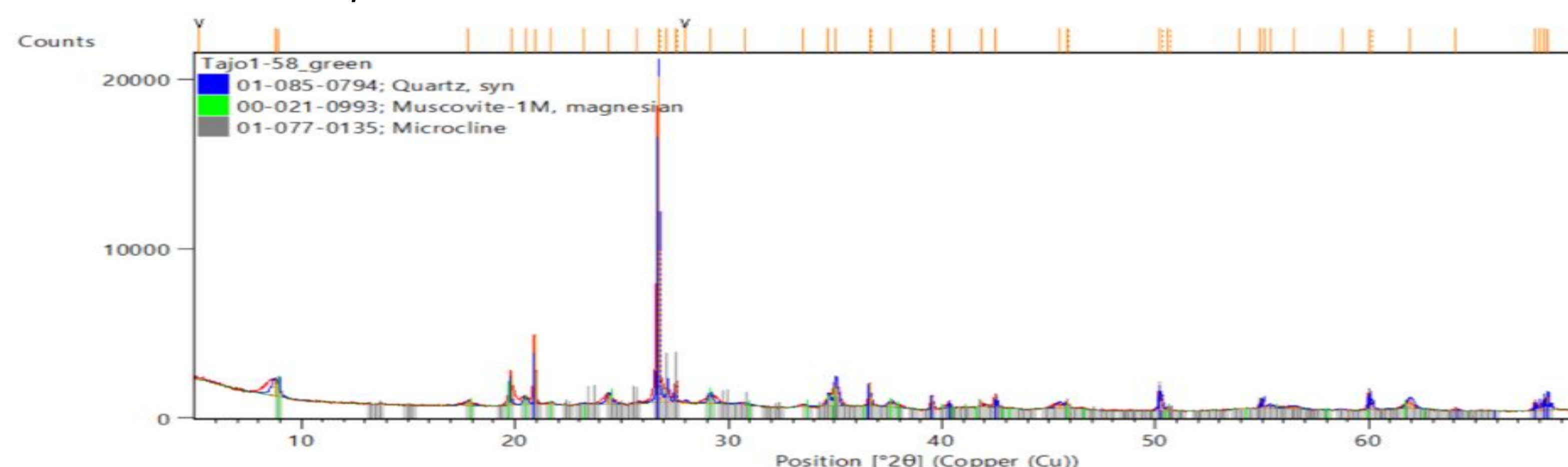
Introduction

In the late 1970s, the Rocky Mountain Energy Company drilled the Tajo granite and established anomalous uranium contents. The geologist who originally analyzed the Tajo granite, Fieldman (1977), compared the granite to a Rossing-type deposit and McLemore (1983) compared it to the Alaskan Bokan Mountains, which both contain important resources of U, Th, and REE. Because of the suggested similarities and established anomalous uranium, the purpose of this study was to further analyze the uranium content of the granite along with other trace elements and REE, and to comment on the economic potential. This was accomplished by analyzing drill core, submitting samples for geochemistry, and looking at thin sections.

From left to right: Individual piece of core displaying a green mineral thought to be uranophane and a complete box of wet core



Figure 1. X-ray diffraction pattern identifying the green mineral as muscovite with microcline and quartz



Methods

- Logged drill core noting mineralogy, color, and alteration
- Prepared and sent samples for XRD, geochemistry, and thin section
- Created various plots to explain the geochemical characteristics
- Analyzed the thin sections noting mineralogical abundances, features, and alteration

Figure 2. Geologic map of the Tajo granite (Precambrian) showing locations of high gamma radiation. McLemore (1983)

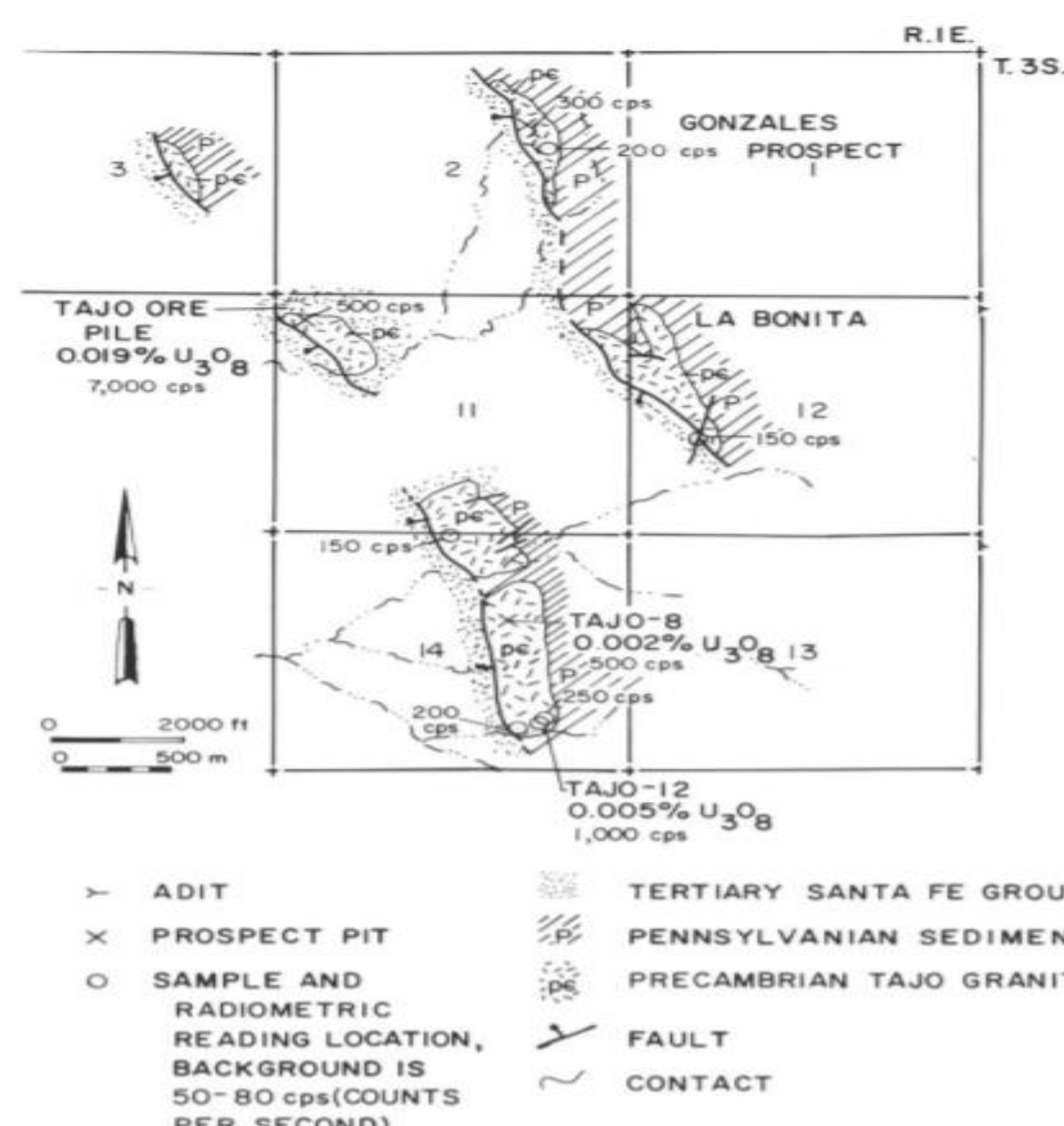


Figure 3. Ternary diagram comparing the Tajo samples with Condie (1971) Proterozoic granite pluton classification

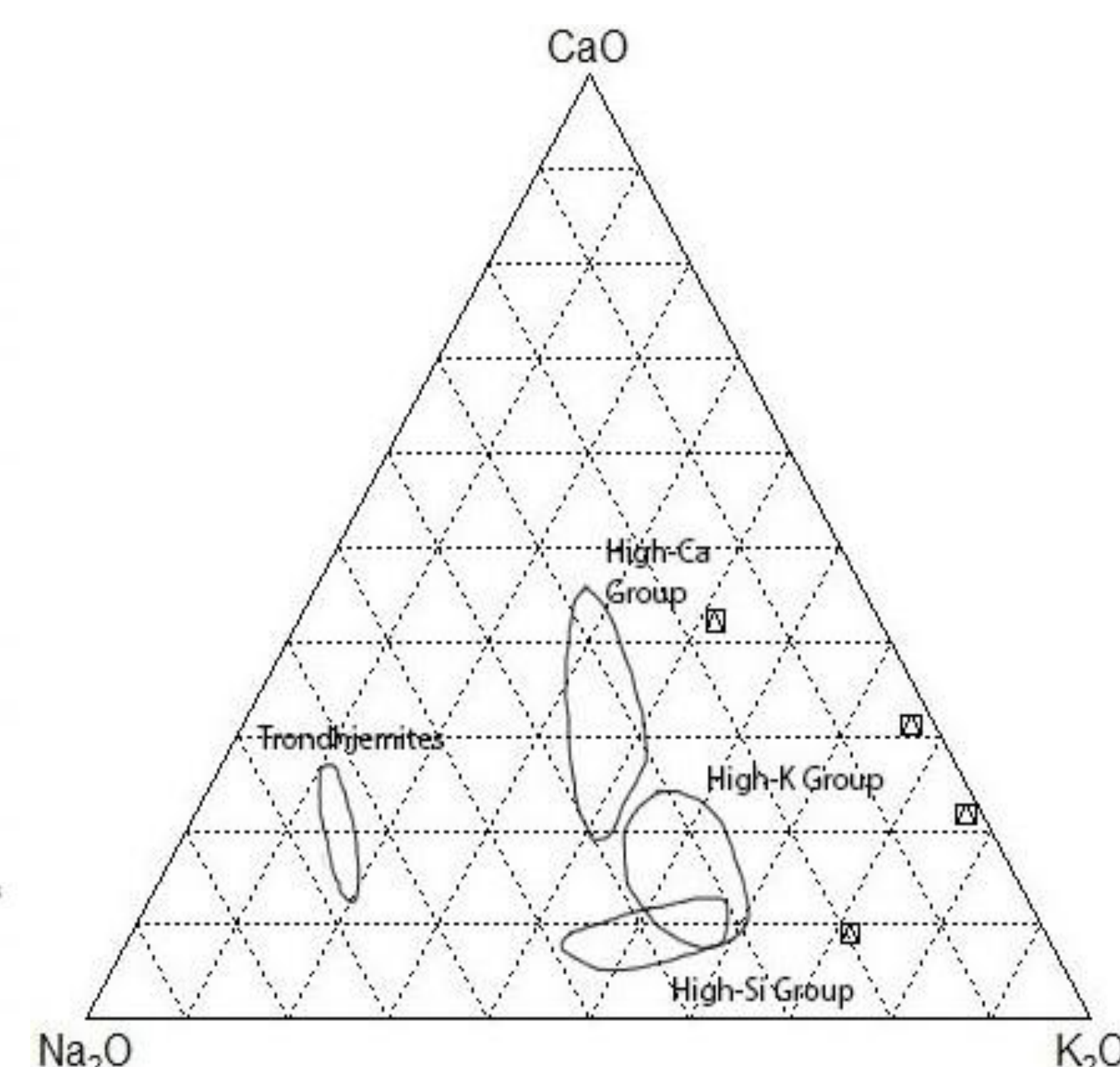
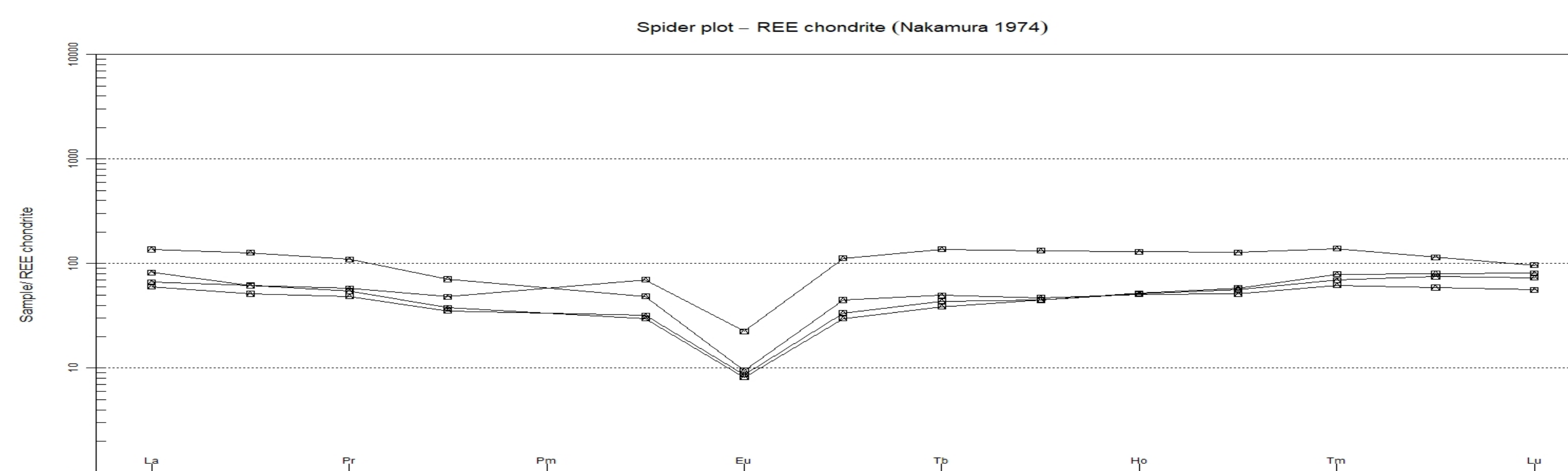


Figure 4. Chondrite-normalized REE values of the Tajo granite, displaying a flat, depleted pattern



Arroyo del Tajo looking west



Figure 5. Chondrite normalized REE values of the high-Si group Precambrian granites from Condie and Budding (1979)

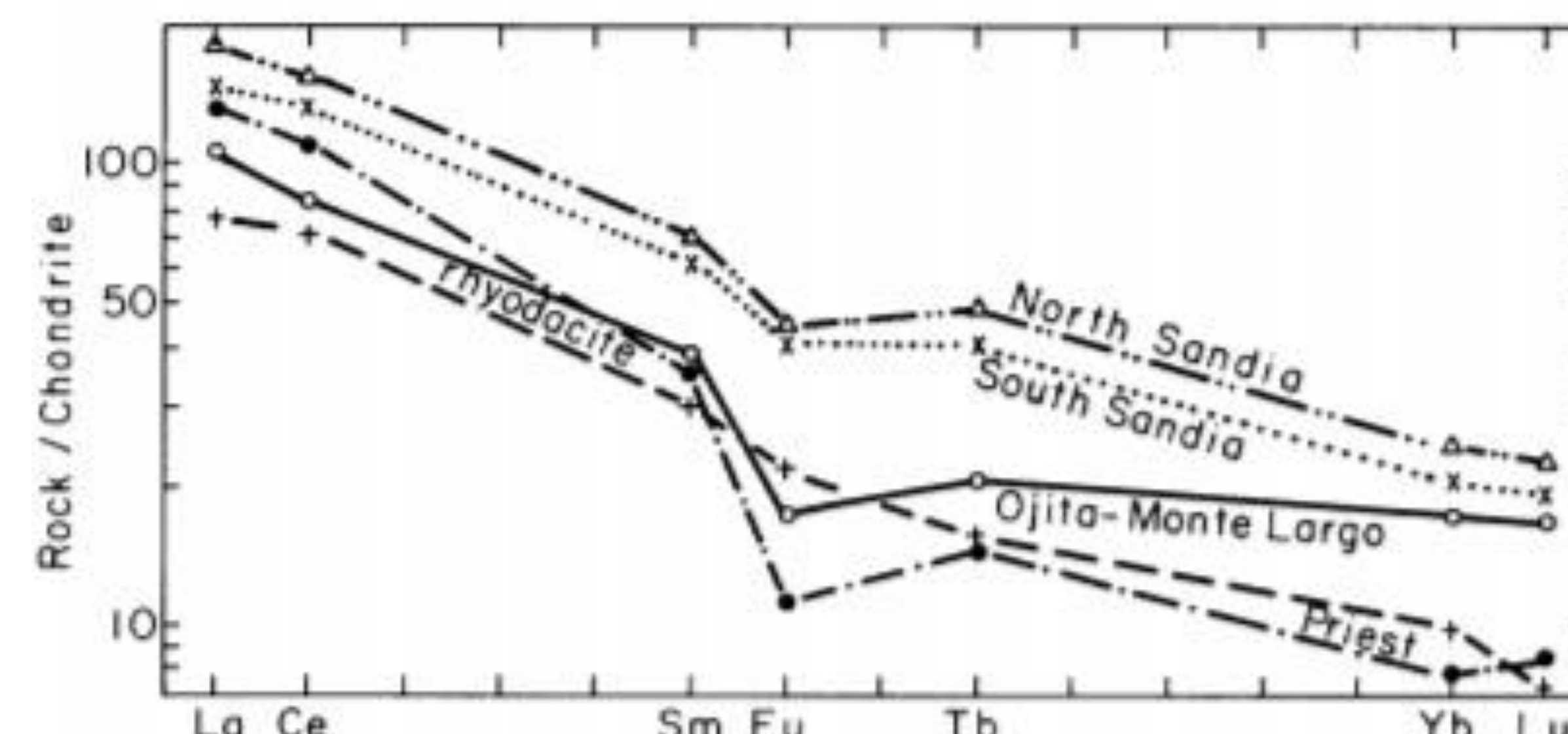
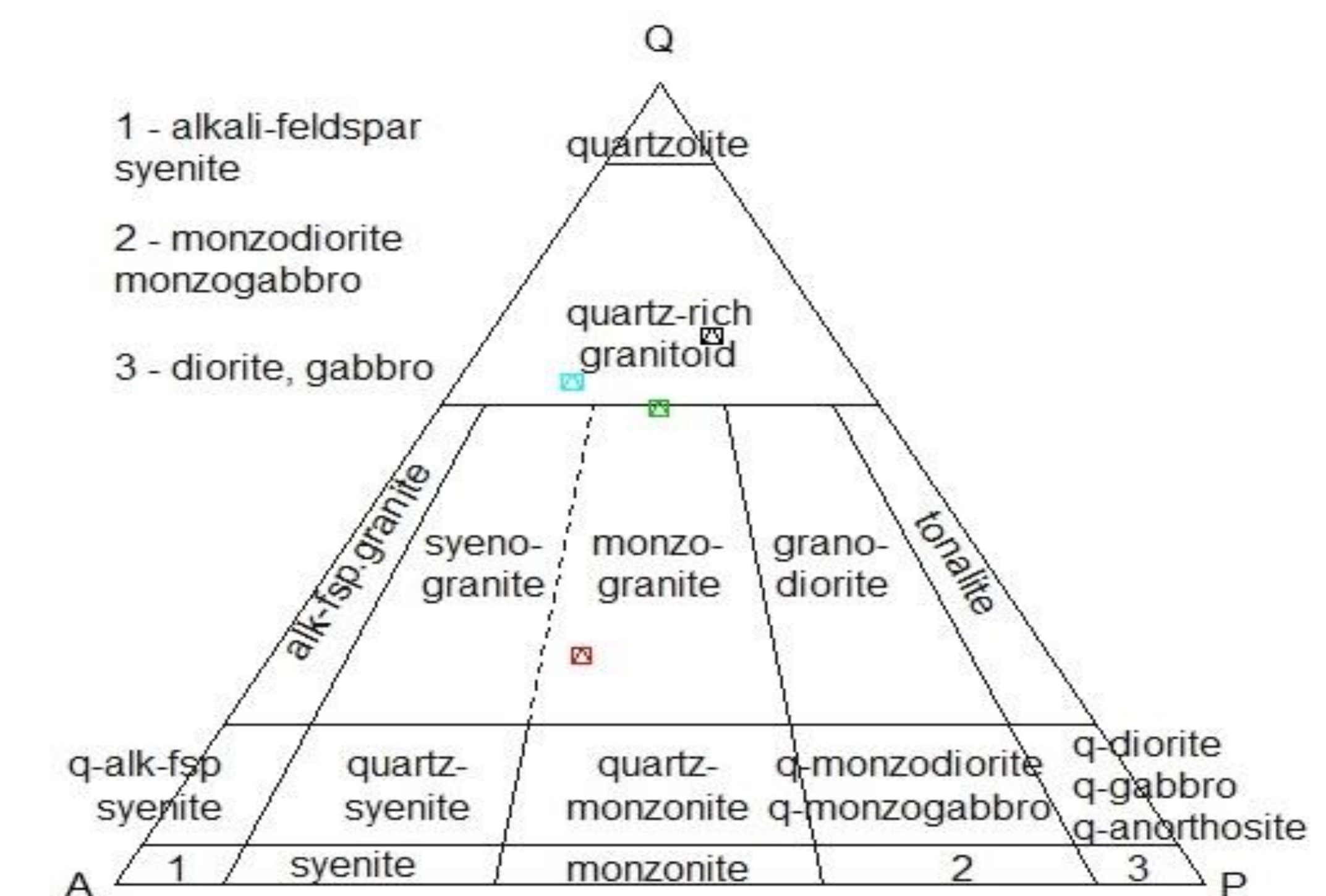


Table 1. Table depicting the Rb, Th, and U values for each sample and the average from Condie (1971)

	Rb (ppm)	Th (ppm)	U (ppm)
Tajo	391	35	182
Tajo 101	181	17	262
Tajo1-30	455	22	20.1
Tajo1-13	353	19	24.5
Average	345	23	122
High-Ca group	173	14	3.7
High-Si group	167	18	5.0
High-K group	272	14	4.0
Average	204	15.3	4.2

Figure 6. QAPF diagram classifying Tajo using modal abundances from thin section analysis



Conclusion

- Tajo is a granite with elevated levels of Th, Rb, and U and depleted REE
- The granite is peraluminous and magnesian
- Tajo is unusual in composition when compared to other New Mexican Proterozoic granite plutons
- Depleted REE and low elevated levels of Th and U make Tajo an uneconomic source at this time
- Future studies would need to characterize petrogenesis and the processes that depleted the REE

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Sources

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