Separation of Plagioclase Feldspars via Chemical Analysis

Shane McClure and Christopher M. Breeding

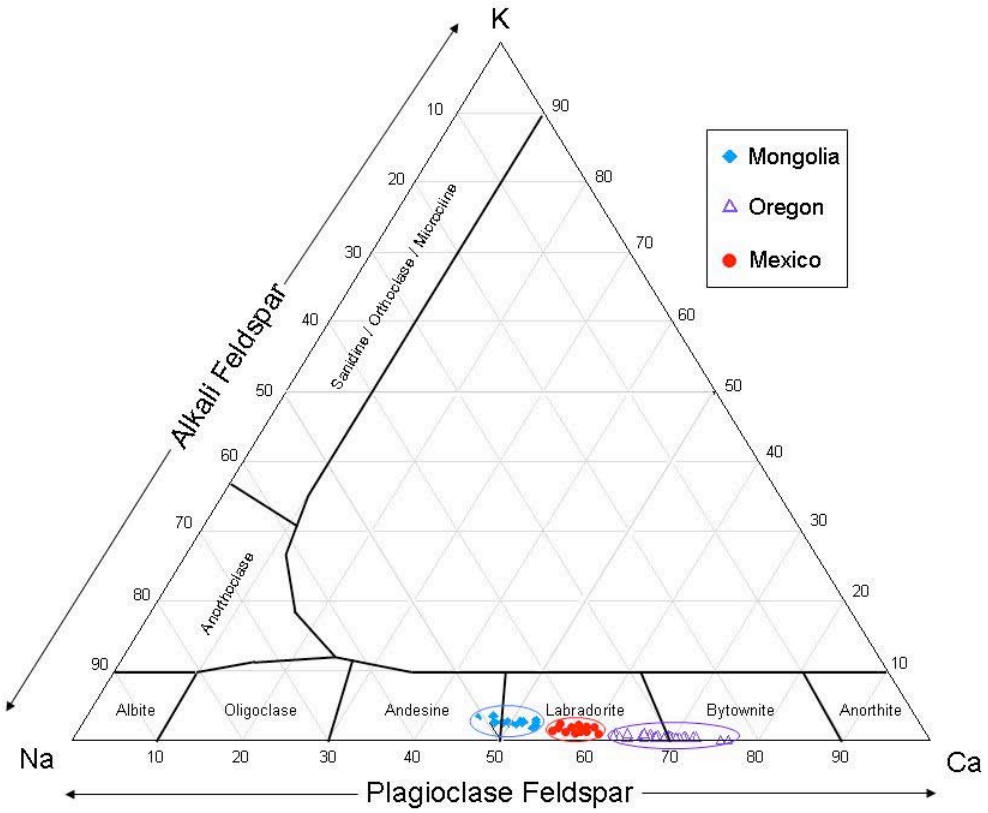
GIA Laboratory, Carlsbad (March 30, 2009)

The potential treatment of feldspar has been the subject of a great deal of discussion over the last year or so. One point of contention that keeps coming up is the idea that feldspar from Mexico has been sent to China to be treated and then sold as untreated Chinese material. While the issue of the treatment of this material is somewhat complicated, the issue of geographic origin is not.

Plagioclase feldspars are divided into six different species based on the chemistry of the material (see figure 1). Albite is the sodium-rich end member, anorthite the calcium-rich end member. The chemistry along this line (known as a solid-solution series) is infinitely variable, meaning an individual specimen may potentially fall anywhere along the continuum. Therefore, even though there are six different species, each represents a range of compositions that is expressed as a percentage of anorthite (An). For example, the range for labradorite (the species most in question) is An_{50} to An_{70}, meaning that labradorite has a composition that includes from 50% to 70 % of the Ca end member. It is reasonable to assume that with such a range available, material from completely different sources could fall in different places within the range. In this particular case, that is exactly what we find.

The three deposits of labradorite most in question are those in the U.S. state of Oregon, Mexico's Casa Grande mine, and Mongolia. Careful chemical analysis of specimens from these localities using normalized LA-ICP-MS analysis shows that they plot in distinctly different groups within the labradorite range with very little overlap. As seen in the diagram, the Oregon material falls in the high-Ca part of the labradorite field and crosses over into the bytownite field (~An_{63-77}). The Mexican material falls in the middle of the labradorite range (~An_{57-63}), and the Mongolian material falls in the low-Ca part of the labradorite field, crossing over into the andesine field (~An_{47-55}). In the samples we have examined, there has been no indication that feldspar treatment affects the sodium and calcium major element chemistry, so the locality fields do not change.

We have tested dozens of specimens from each locality and can say without hesitation that none of those reported to be from Mongolia, treated or not, were actually from Mexico. This same result has been reached independently by others investigating the subject.



This standard ternary feldspar diagram shows the chemical composition ranges for the Mongolian, Oregon, and Mexican plagioclase feldspars examined. Note that the three locality fields are clearly distinct from each other.