Red Feldspar – A Puzzle to Fix

Introduction

In 2002, red feldspar said to be from the Congo appeared on the gemstone market. These stones were up to 30 ct in size and internally very clean. The Congolese material was reported to originate in an area about 100 km southwest of Goma. However, the existence of the mine has never been validated. At the 2005 Tucson gem shows, a large number of red feldspars were being marketed as "Chinese andesine." Similar stones appeared the following year in Tucson, marketed as "Tibet sunstone." Red andesine was also promoted as an official gemstone of the 2008 Olympic Games in Beijing.

Given that red feldspar had been a relatively rare gemstone prior to this, concern arose in the trade that the stones had been treated in some manner to improve their color (e.g., R. James, July 23, 2008, ISG report on the diffusion treatment of andesine. http://www.schoolofgemology.com/GemResearch/ISGAndesineReport.html)

Red color in labradorite is caused the presence of copper (Cu). Depending on the particle size, the concentration of Cu, and the temperature at which exsolution is initiated, a red coloration or a bronzy, iridescent schiller effect can be achieved (Hofmeister and Rossman, 1985).

Between June and October 2008, Dr. John Emmett conducted experiments to see if Cu could be easily diffused into feldspar, and if this process would produce a red color in the stones. Emmett's experiments were successful and proved the potential viability of Cu diffusion treatment, offering a possible explanation for the abundance of red feldspar on the market.

During a visit to China in October and November of 2008, Dr. Ahmadjan Abduriyim visited Inner Mongolian mines that produce large quantities of near-colorless transparent feldspar. There he learned of a new technique to diffuse Cu into this material and induce a commercially popular red color. Dr. Abduriyim also visited a small mine in Tibet where he witnessed the mining of red feldspar.

Using $^{40}Ar/^{36}Ar$ ratios and other geochemical analyses and samples from various locations, including Inner Mongolia and Tibet, Dr. George Rossman determined that the Cu-diffused material from Mongolia and the red feldspar from Tibet were essentially identical, which questions the authenticity of the Tibetan mine.

Against this backdrop, meetings were held August 21, 2009, at GIA Carlsbad headquarter, during which the current status of research could be openly discussed and a way forward to resolution could be reached.

Following is a list of the presentations and links to summaries of them:

Dr. Ahmadjan Abduriyim
Gemmological Association of All Japan (GAAJ) Laboratory, Tokyo, Japan
A Mine Trip to Tibet and Inner Mongolia: Gemmological Study of Andesine Feldspar

Dr. George Rossman
California Institute of Technology, California
The Red Feldspar Project – Interim Report

Dr. John Emmett
C*rystal Chemistry, Brush Prairie, Washington*
Copper Diffusion in Plagioclase

Mr. Shane McClure
GIA Laboratory, Carlsbad, California
Observations on Identification of Treated Feldspar

Dr. Kamolwan Thirangoon
GIA Laboratory, Bangkok, Thailand
Observation on Effects of Heating and Copper Diffusion in Feldspar

Resolutions

Extensive discussion followed each presentation and again at the end of the meeting, as the participants sought a jointly sponsored approach to resolution. The principal issues on the table were:

• Does the red feldspar mine in Tibet actually exist?
There was equally compelling evidence both for and against the mine's existence. It was resolved to undertake another expedition to the mine site, and others nearby that are reportedly in production. However, this visit would involve additional personnel to evaluate the site from various perspectives. The team designated for this expedition would include Ahmadjan Abduriyim (GAAJ) and Wuyi Wang (GIA), plus at least one other researcher with considerable knowledge of sedimentary geology and/or gemstone mining. Possible participant(s) have yet to be confirmed.

Further, the investigators should have unfettered access to all known mines in the area that are said to be producing red feldspar. Once onsite, the expedition should be allowed to dig or witness the digging of a large volume of red feldspar specimens for evaluation in the laboratories of Caltech, GIA, and GAAJ. Further, the sedimentary geologist and mining expert should be allowed to survey the entire area and report their findings without hindrance.

Given that it is a simple process to separate the various sources of transparent feldspar, a finding that the mine does not exist would mean that a determination of Cu diffusion in red feldspar may rest simply with a determination of Chinese origin. But if it is found that the mine *does* exist, the issue on the table will be

• How can red feldspar from Tibet be separated from the Cu-diffused material from Mongolia?

Some assumptions can be made at this stage, such as **t**he relatively higher levels of Cu in the diffused material. Before any conclusions can be reached, sample integrity must be established. Given the labyrinth of apparent misinformation that has surrounded this situation, only samples that have been collected onsite by a trusted team with no commercial connection to the mines can be considered valid.

Closely linked with this issue is the inevitable situation where material from either Oregon or Mexico (or both) is diffused with copper

• **How can Cu-diffused feldspar from Oregon or Mexico be recognized?**
Here the issue is easier to resolve, given the known history of both sites and the type of material mined. It also remains easier to obtain specimens that have the proper integrity from these sites. Furthermore, the origin of both materials is easily determined.

References

Hofmeister A. M., Rossman G.R. (1985) Exsolution of metallic copper from Lake County labradorite. *Geology*, Vol. 13, No. 9, pp. 644–647.