An Exploration Model for Gemstones in Central Asia:
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ABSTRACT

Archaeological evidence and early historic records attest to production from mines in remote regions of Central Asia. Afghanistan has been a source for gems and precious minerals since prehistoric times. Production from some of these deposits has continued to the present time. However, political disruptions and lack of infrastructure have limited the exploitation of these resources and the exploration for new sources.

The usefulness of remote sensing techniques for ore mineral exploration has been demonstrated over the last several decades. However, these techniques have not seen much use in gemstone exploration. This is due, in part, to the large variety of gemstone deposits and the need to develop an exploration model that relies on the recognition of alteration zones in immediate proximity to the mineral deposits. This hinders the development of a general model that can be widely employed. This presentation describes a preliminary interpretation of remote sensing data and laboratory analysis of samples from the Emerald deposits of the Panjshir valley in Afghanistan. The arid environment, the occurrence of historic deposits and availability of samples from these locales for ground-truth studies make this area suitable for development of an exploration model.

Preliminary spectroscopic analysis of rocks from the Khenj emerald mine in the Panjshir valley, show spectral differences in the altered rocks that host the emeralds and the surrounding country rock, and between country rocks of differing metamorphic grade. The altered assemblage shows very strong absorptions resulting from the presence of goethite and jarosite as well as absorption features that can be attributed to muscovite with a high concentration of aluminum. These features are absent in the metamorphic country rocks. In the unaltered zones the spectra reveal evidence for variation in metamorphic grade.

Where alteration zones are large enough to be visible to register on airborne or satellite imagery, the differences in spectral signature may permit the recognition of unexploited gem deposits.

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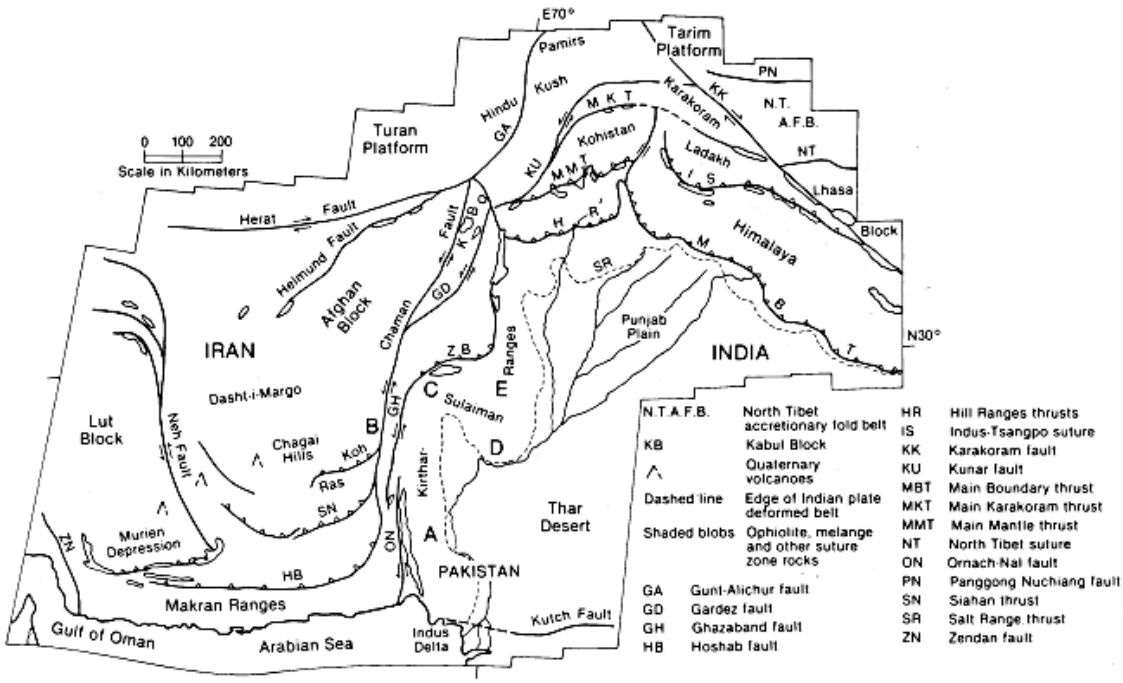

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