

GEOCHEMICAL CHARACTERISTICS OF PEGMATITES FROM LESSER HIMALAYAS, PAKISTAN: IMPLICATIONS FOR FRACTIONATION AND ECONOMIC MINERALIZATION POTENTIAL

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Abstract

Highly fractionated pegmatites, which are genetically related to per-aluminous S-type granites, are designated as LCT-type (Li, Cs and Ta rich pegmatites). Such pegmatites are mined for strategic metals (SMs) and rare earth elements (REEs) around the world. The S-type granitic suites of the Lesser Himalayan sequence, specifically the Mansehra Granitic Complex (MGC) of northwestern Pakistan, have not been studied so far from this perspective. Geochemical signatures of the MGC pegmatites were investigated using Inductive Coupled Plasma Mass Spectroscopy (ICP-MS) to assess the degree of their fractionation and economic mineral potential. In general, the REE patterns of the studied bulk rock pegmatite display tetrad effect and low total REE abundances, strong positive Eu anomalies, weak negative Ce anomalies and relative enrichment in heavy REE. Similar features were also observed in the REE patterns of their feldspar extracts. However, the REE patterns of muscovite extracts reflect preferential enrichment and possess moderate to high total REE abundances, negative Eu anomalies, prominent negative Ce anomalies and relative enrichment in heavy REE.

Relationships between the concentrations of a number of trace elements (and their ratios), e.g. Ta versus Cs, K/Rb versus Rb and Th/U versus K/Cs, were used to assess the economically viable mineral potential of the studied pegmatites. The concentrations of most of the relevant components fall below the mineralization line and confer either barren or low-level mineralization potential of the MGC pegmatites for SMs (e.g. Ta and Nb) and REEs. The close spatial association with parent granitic rocks and absence of zoning also reflect the low degree of fractional crystallization and barren nature of the MGC pegmatites.