FRACTIONATION OF HIGH-FIELD-STRENGTH ELEMENTS (HFSE) AND PETROGENETIC INDICATORS IN NYF-TYPE PEGMATITES

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NYF-type pegmatites are characterized by high F, FeO/MgO ratios, and high/economic concentrations of Nb, Y, Zr, Th, U, REE (except Eu), and Ga. F plays a critical role in the development of NYF-type pegmatite chemistry and mineralogy. In the presence of F, many HFSE behave incompatibly and are thus strongly concentrated in highly differentiated NYF-type pegmatites in such phases as zircon, rutile, columbite-tantalite, samarskite and other REE minerals. It appears that many NYF-type pegmatites, such as those in the South Platte District, Colorado and Wausau Syenite Complex, Wisconsin, are genetically related to anorogenic, sub- to metaluminous (to peralkaline) granitoids, a major component of which is derived from F-rich, Proterozoic crustal sources depleted in Li, Cs, B, and P. The degree of pegmatite fractionation has been evaluated using indicators such as K/Rb, K/Cs, and Fe/Mn. While this works well for LCT-type pegmatites (derived from orogenic, I/S-type granites enriched in Li, Cs, Ta, and B), these elements do not effectively measure the degree of fractionation in NYF-type pegmatites. NYF fractionation may be better evaluated using elements enriched in A-type granites i.e. Nb, Y, F, REE, Zr and Ga. The extreme concentration of REE+Y, Nb, and F in South Platte pegmatites suggests that they are just as evolved as their LCT-type counterparts.The composition of biotite in NYF-type pegmatites is distinctly different from that in LCT-type pegmatites. NYF-type biotites crystallized under relatively reducing fO_2 conditions and low fH_2O, are annite-rich with high F and Ga/Al. Therefore, biotite composition can be used as an indicator of tectonic regime associated with pegmatite genesis.