Comprehensive alkali feldspar/melt trace-element partitioning models for silicic magmas

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Alkali feldspar / silicic magma trace-element partition coefficients (D's) for Rb, Sr, Ba, Eu, Y, Zr, Nb, and trivalent REE for peralkalic and peraluminous melt are presented. D values for incompatible elements vary systematically with melt polymerization parameters, increasing with whole-rock silica, but decreasing in rocks with high agpaitic indices (A.I. = mol Na+K/Al). D's for compatible elements (Sr and Ba) vary systematically with crystal chemistry. The compatible trace-element D's show different patterns in peralkalic and peraluminous system. These regular variations strongly suggest that partition coefficients for these elements may be accurately predicted if whole-rock and crystal chemical parameters are known.

Multivariate linear regression analysis (MLR) has been used to develop equations for predicting alkali feldspar/melt trace-element D's for large-ion lithophile elements (Rb and Eu), high field strength elements (Zr and Nb), and rare earth elements. D_{Rb} can be calculated given feldspar Or content and A.I. D_{Eu} and other D_{REE} can be calculated given whole-rock SiO_2, A.I., and feldspar major compositions. Influence factors for Sr and Ba are different in different magma systems. D_{Sr} for samples from Pantelleria increase with increasing feldspar Ab content. D_{Sr} for peraluminous magma closely correlate with feldspar An content. MLR equations were developed based on different types of magma systems. Alkali feldspar crystal structure may have the influence on Ba partitioning. The large variation of D_{Ba} makes partitioning behavior of Ba difficult to predict.

Three dimensional model in the evolution of cuddapah alkaline province Andhra Pradesh, India – Geochemical perspective

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The isolated pockets of silicic magmatism has been encountered in the Cuddapah Alkaline Province, Andhra Pradesh, South India. The magmatic differentiates include tholeiitic to mildly alkaline intrusives derived from the mafic xenolithic magmatic fractions. The relative abundance of both oversaturated silica rocks and undersaturated silica deficient rocks in the association with saturated rocks varies from zone to zone in the province. The province overall constitutes wide variety of contrasting syenitic differentiates derived from single parental magma. The province is located along the eastern margin of the intracratonic Proterozoic Cuddapah crescent of South Indian craton. It is more conspicuously confined to an extremely narrow linear belt which is close to known basement fracture zone with which the major Bouguer gravity axis is parallel in a NNE-SSW direction. This particular belt lies at the junction zone between two fold belts i.e. Dharwar (granite-greenstone) belt towards the west and Eastern Ghat (gneiss-granulite) mobile belt towards east. The entire province is composed of syenitic variants with ocellar lamprophyres and doleritic dykes with distinct mineralogy. This province was post-kinematic tectonically controlled and passive emplacement into Precambrian amphibolite and granite gneiss. The syenitic fractions are water deficient (dry) and water sufficient (hydrous) natiure.The geochemical and mineralogical behavious of the two diversified fractions suggest that the process of differentiation takes place under fluctuating P-T-fo conditions of the province. Based on the observations made the two possible evolutionary mechanisms are suggested. 1. Gabbro → Fayalite Clinopyroxene (FC) syenite → Fayalite-quartz (FQ) syenite → Quartz syenite → Granite. 2. Mafic alkaline rock → Hornblende syenite → Nepheline syenite. The other possible mechanism is by branching differentiation mechanism (BDM) ie.: Mafic alkaline rock → Hornblende syenite → BDM → Nepheline syenite → Quartz syenite [off shoot: FQ syenite]. The suggested mechanisms clearly reflects the nature of magma in the province and it is from tholeiitic to alkaline magma in nature. However there are certain constraints in establishing the suitable mechanism due to the presence of dry and hydrous magmatic fractions in the province. a) The source by which magma acquires water when initial magma is of dry nature. b) Whether simultaneous crystallization of both the fractions allowed the magma to acquire water from the residual magma. c) Whether all the fractions evolved from the single parental magma i.e. mafic alkaline fraction. d) Whether the presence of ocelli in lamprophyres suggest liquid immiscibility fraction.