

magnetite, ankerite, siderite, magnesite, strontianite, and monazite as major constituent, and columbite, fergusonite, apatite, aegirine-augite, Na-amphibole, phlogopite, and sulfides as accessories. Wall rock is replaced to fenite having mainly sugary albite and Na-amphibole. Monazite is the main mineral for REE deposit and shows myrmekitic intergrowth with strontianite corroded by other carbonate minerals. Mineral forming sequence can be divided into early and late periods by microfracture development. The early period minerals such as magnetite and apatite show well developed networks of microfractures due to cataclastic deformation. The late minerals having little microfractures of columbite, fergusonite, siderite, some sulfides are formed after brecciation event. The continuous minerals showing both well developed and poorly developed fractures of ankerite, magnesite, monazite, strontianite, barite and pyrite have been formed continuously from early to late period. Mineral chemistry, mineral assemblages of various carbonates and magnetite, mineral texture, and wall rock of well developed fenite strongly represent this studied rock is originated from carbonatitic melt and its rock type is the late differentiated phoscorite, one of Fe-carbonatites, firstly reported in S. Korea.

106-25 Poster Ruberti, Excelso

HYDROTHERMAL LREE-FLUOROCARBONATE MINERALIZATION IN THE BARRA DO ITAPIRAPUA CARBONATITE, SOUTHERN BRAZIL

RUBERTI Excelso¹, ANDRADE Fabio Ramos Dias¹, ENRICH Gaston Eduardo¹
¹ - Instituto de Geociências - Universidade de São Paulo

Keywords: REE-fluorocarbonates; carbonatites; synchysite; parsite; Southern Brazil

The Barra do Itaipirapua carbonatite belongs to the Cretaceous alkaline province, southern Brazil, and is emplaced in a Proterozoic granite at the eastern fringe of the Ponta Grossa Arch. A multi-stage magmatic evolution was recognized, comprising medium- to coarse-grained magnesio- and ferrocarnatites, and minor amounts of late-stage fine-grained ferro-, magnesio- and calcicocarnatites. The coarse-grained carbonatites were overprinted by late- to post-magmatic pervasive hydrothermal alteration, that led to formation of corrosion cavities containing mostly quartz, significant amounts of REE-fluorocarbonates and/or apatite, together with fluorite, barite, sulfides and Fe-oxides. REE-fluorocarbonates occur as fine-scale intergrowths in fibroradiated aggregates or as randomly oriented laths, where synchysite prevails over parsite. Synchysite locally occurs as radial fibres around a parsite core, but often stripes of parsite appear within laths of synchysite or as thin rims. Ca/REE ratios in most analyses vary within the range of stoichiometric parsite [(REE)2Ca(CO3)3F2] and synchysite [(REE)Ca(CO3)2F]. There is an enrichment in thorium (up to 5.1 wt% ThO2), which is not related to the CaO content. LREE concentrations are between 44 and 60 wt% LREE2O3, while Y plus HREE2O3 varies between 0.11 and 0.82 wt%. LREE:(HREE+Y) ratios vary between 53 and 331. Calcium predominates as the divalent cation (CaO > 2.3 wt%), and it is higher in synchysite (17.5-11.9 wt% CaO) than in parsite (9.9-1.2 wt% CaO), while SrO concentration ranges from 0.7 to 2.3 wt%. P, U, Pb, Si and Al occur in concentrations less than 0.25 wt%. The F-rich nature and high to very low content of Ca in the LREE-fluorocarbonate assemblage imply that the minerals crystallized from a high F and variable Ca-bearing aqueous solution under conditions of high activity of (CO3)2-, in which the LREE were selectively partitioned into the solution, probably as soluble fluoride complexes. The mineralizing fluids were probably composed by magmatic residual volatiles together with an aqueous crustal component, where the former brought mainly the REE and the latter SiO2 into the overprinted rocks. This hydrothermal process has added LREE to the original rocks, as indicated by an increase of up to 10000 times in the whole-rock LREE composition, together with an enhancement of chondrite-normalized LREE/HREE ratios compared with non-overprinted rocks.

106-26 Poster Ruberti, Excelso

PEROVSKITES FROM INTRUSIONS OF KIMBERLITIC AFFINITIES, ALTO PARANAIBA IGNEOUS PROVINCE, BRAZIL

AZZONE Rogério Guitarrari¹, RUBERTI Excelso¹

¹ - Instituto de Geociências - Universidade de São Paulo, Brazil

Keywords: perovskites; kimberlites; mineral chemistry; Alto Paranaiba Province; Brazil

Perovskite is a ubiquitous accessory mineral in the ultrabasic rocks with kimberlitic affinities at the Alto Paranaiba Igneous Province, SW Minas Gerais and SE Goiás States, Brazil. In different intrusions, perovskite shows distinct textural features and a wide range of composition. In this work, we give a detailed characterization of perovskite paragenesis from the Pantano and Fazenda Alagoinha intrusions. At Pantano, perovskite forms euhedral or subhedral rounded crystals ranging in size from 0.02mm in groundmass to 0.7mm as microphenocrysts (average 0.2mm). The highest concentrations of the mineral occur in the groundmass. It is brown, green, yellow or sometimes opaque, invariably complexly twinned and zoned (e.g., normal or oscillatory zoning). Chemically, perovskite (ABO3) in Pantano contains high Ca and Ti contents (>0.916pfu Ca and >0.958pfu Ti, occupying most of A and B sites, respectively) and very low levels of REE (up to 0.023pfu Ce, 0.009pfu La and 0.010pfu Nd); other ions are Na, Fe, Sr and Nb (up to 0.042pfu, 0.038pfu, 0.008pfu, 0.007pfu, respectively). REE2O3 vary from 5 wt% in the core to 0.44 wt% at the rim; Na decreases toward the rim. Perovskite at Pantano corresponds to REE-poor perovskites. On the other hand, at Fazenda Alagoinha perovskite occurs only as minute crystals typically smaller than 0.1mm, in the groundmass. Here, perovskite is greenish or practically opaque and weakly zoned. It contains high Ca and Ti (0.687-0.915pfu Ca and 0.890-0.963pfu Ti) and high levels of REE (REE2O3 up to 16.28 wt% in the core and 3.01 wt% in the rim: 0.082-0.012pfu Ce, 0.033-0.008pfu La, 0.025-0.007pfu Nd from core to rim). Other ions are Na, Fe, Nb and Sr (up to 0.151pfu, 0.040pfu, 0.031pfu, 0.012pfu, respectively). Perovskite at Fazenda Alagoinha corresponds to REE-enriched perovskites. Perovskites from worldwide kimberlites approach the ideal formula CaTiO3, and normally contain less than 7 mol% of other end-members, like that from Pantano. However, higher levels of REE, like that from Fazenda Alagoinha, are observed in perovskites from some kimberlites such as Lac de Gras and Kirkland Lake in Canada or Obnazhennaya in Yakutia, Russia, and probably result from inherent enrichment of the host kimberlites in incompatible elements, in some cases with a possible contribution of differentiation processes.

106-27 Poster Ruberti, Excelso

HIORTDAHLITE, LÄVENITE AND WÖHLERITE FROM NEPHELINE MICROSYENITE DYKES OF MONTE DE TRIGO ISLAND ALKALINE COMPLEX, SOUTHEASTERN BRAZIL

ENRICH Gaston Eduardo¹, RUBERTI Excelso¹

¹ - Instituto de Geociências - Universidade de São Paulo

Keywords: Hiortdahlite; Wöhlerite; Låvenite; Alkaline rocks; Brazil

Hiortdahlite, låvenite and wöhlerite, sorosilicates of the cuspidine-wöhlerite

group, are described for the first time in the Cretaceous syenitic-gabbroic intrusion of Monte de Trigo Island alkaline complex, Serra do Mar Province, SE Brazil. These minerals occur in five hololeucocratic apaitic nepheline syenite dykes cutting clinopyroxene cumulates, olivine gabbro and theralite. Such dykes belong to late magmatic stages in the evolution of a predominantly miaskitic nepheline syenite stock. The three silicates are associated with aegirine, magnetite, titanite, zircon, eudialyte, baddeleyite, pyrochlore, loparite, apatite, britholite and fluorite. Hiortdahlite and wöhlerite form prismatic euhedral to subhedral crystals, showing optical properties similar to the epidote group, whereas låvenite is anhedral and strongly pleochroic (yellow to colorless). EMP analyses of these mineral were performed at 25 kV and 100nA. Hiortdahlite [NaCa2Zr1-x(Si2O7)(O,OH,F)2] shows Zr contents of 0.5-0.6 pfu, while the amounts of Ca, Na and F match the ideal formula. Minor amounts of Mn+Fe+Mg (0.148-0.228 pfu), Nb (0.032-0.095 pfu), Ti (0.019-0.043 pfu) and REE+Y (0.022-0.084 pfu) replace Zr and Ca. Wöhlerite [NaCa2(Zr,Nb)(Si2O7)(O,OH,F)2] is characterized by the prevalence of Zr (0.460-0.633 pfu) upon Nb (0.232-0.411 pfu), with cation occupancy of Ca, Na and F close to the ideal formula. Minor amounts of Mn+Fe+Mg (0.115-0.300 pfu), Ti (0.047-0.087 pfu) and REE+Y (0.020-0.041 pfu) occur. Låvenite [(Na,Ca)2(Ca,Mn,Fe)Zr(Si2O7)(O,OH,F)2] contains Zr (0.766 to 0.911 pfu), Mn+Fe+Mg (0.481-0.553 pfu), Ca (0.928-1.423 pfu), Na (1.102-1.553 pfu) and F (av. 1.06 pfu), as per ideal formula. Other ions are Ti (0.039-0.198 pfu), Nb (0.021-0.112 pfu) and HREE+Y (0.013-0.054 pfu), with LREE below detection limits. Hiortdahlite and wöhlerite chondritic normalized REE patterns show variable LaN/YbN ratios (0.040 to 2.32). The coexistence of zircon and complex Na-Ca-Zr-F silicates indicates the intermediate apaitic character of these dykes. Higher contents of alkalis, F, REE and HFSE existing in the mineral paragenesis reveal the residual nature of the nepheline syenitic magma. The relative excess of Ca in the residual melt, probably due to the assimilation of mafic/ultramafic country rocks, promotes the crystallization of hiortdahlite, låvenite and wöhlerite.

106-28 Poster Belkin, Harvey E.

GEOCHEMISTRY OF CAMPANIAN IGNI MBRITES

BELKIN Harvey E.¹, BOHRSON W.A.², DE VIVO Benedetto³, ROLANDI G.³, SOMMA Renato³, SPERA F.J.³

¹ - 956 National Center, U.S. Geological Survey, Reston, VA 20192, USA

² - Department of Geological Sciences, Central Washington University, Ellensburg, WA, 98926, USA

³ - Dipartimento di Geofisica e Vulcanologia, Università di Napoli Federico II, Napoli, Italy

⁴ - Department of Geological Sciences and Institute for Crustal Studies, University of California, Santa Barbara, 93101, USA

Keywords: Ignimbrite; Campanian; Geochemistry

The ~200 km² (dense rock equivalent) trachytic Campanian Ignimbrite, which is situated northwest of Naples, Italy is one of the largest eruptions in the Mediterranean region in the last 200 ky. Recent detailed stratigraphic analysis and ⁴⁰Ar/³⁹Ar dating of sanidine has defined the age at 39.3 ± 0.1 ka. Geochemistry and geochemistry of tuff and ignimbrite units below the Campanian Ignimbrite have revealed a complex eruptive history extending back approximately 200 ky. We have obtained 100 new chemical analysis from a wide range of geographic and stratigraphic locations. These analyses include major elements, minor elements, volatiles (F, Cl, Br, S, B, Li, H₂O), rare-earth elements, and heavy metals important for environmental baseline studies (Pb, Ti, As, Hg, U). Rock types include pumice, scoria, and moderately welded to poorly welded ignimbrite of both the yellow and grey facies. Analyses normalized to a volatile-free basis indicate minor compositional gradients within major elements (e.g., SiO₂ 58-62 wt.%) whereas minor elements exhibit striking compositional gradients as a function of stratigraphy. The stratigraphic section at the Taurano locality shows the effects of eruption from a compositionally zoned magma body. For example, Sr, Sc, and V show enrichment up-section, whereas La, Y, and U show depletion up-section. Volatile and potentially mobile elements such as Cl, Li, and Rb reveal a scattered pattern indicating either irregular distribution pre-eruption or post-eruption secondary alteration. The detailed geochemistry will help to model fractionation processes operating in the magma chamber, volatile degassing, and the nature of post-eruption alteration.

106-29 Poster Muravyeva, Natalya

ABSAKOKITES AND RELATED BASALTOIDES FROM SOUTHERN URAL MOUNTAINS: PETROLOGY AND GEOCHEMISTRY OF PALAEOZOIC ALKALINE ARC MAGMATISM

MURAVYEVA Natalya¹

¹ - Vernadsky Institute Geochemistry RAS, Moscow

Keywords: igneous petrology; clinopyroxene; alkaline magmatism; geochemistry; geothermobarometry

The late Devonian absakokite-shonkinite association include sheludivogorsky volcanic complex and uschelsky plutonic complex occurred in the Uyskol zone (Southern Ural Mountains), that distinct two structural units - Magnitogorsky and East Ural megablocks. Study of magmatism in this zone is very important for understanding the geological history of Southern Ural. The sheludivogorsky volcanic complex has pro-longation 40 km and width up to 3 km, the thickness of basalts is about 4000 m. There are three patches in sheludivogorsky volcanic complex, distinguished on strati-graphy and petrography. The most part of rocks are represented by alkaline basalts (absakokites) among which are found poorly differentiated variety with MgO > 8 %. The normative (CIPW) composition of the rocks range on from ne-normative alkaline basalt to Q-normative tholeiite. Major and trace elements were determined (NAA and other methods) in each group of rocks. Characteristic geochemical feature of the complex is enrichment by K and LILE, especially for rocks from bottom and middle part. The clinopyroxene is most often occurred mineral, that common in phenocrysts and groundmass. The composition of clinopyroxene and other primary and secondary rock-forming minerals (spinel, feldspar, epidote, garnet, aktinolit) was analyzed with electron microprobe. T - P - conditions crystallization alkaline rocks of sheludivogorsky volcanic complex were determined on base equilibrium "clinopyroxene-liquid". The temperatures estimated by geothermobarometer Putirka K. et al. (1996), range from 1230 to 1270 °C, that correspond to temperatures of basalt liquids. Pres-sure values are 5 - 10 kbar, that was given depths up to 30 km, i.e. the intermediate magmatic chamber, located in the earth's crust or the top part of the upper mantle. High values Mg # (up to 0.72) and concentrations Cr and Ni (up to 685 and 311 ppm, accordingly) in the basalts, high contents Cr2O3 in clinopyroxene phenocryst (up to 1.0%) also suggest about upper mantle origin melts from which they have been formed. High values Ba/La and La/Nb (1.12 - 1.30 and 1.50 - 4.55, accordingly) in rocks of sheludivogorsky complex relative to similar values for basalts MORB (Ba/La - 3.56; La/Nb - 1.11) are typical for island arc magmatism. The values La/Yb are high enough (5.5) and also close to island arc shoshonite series.