The HP stability of Bloedite ($Na_2Mg(SO_4)_2$ $4H_2O$: a contribution to the knowledge of asteroids and icy satellites

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Bloedite, $Na_2Mg(SO_4)_2H_2O$ is a common mineral in evaporitic marine sediments. Being one of the phases in the system H_2O-$MgSO_4$-$NaSO_4$ it has a large planetological interest. In fact volatiles of icy satellites are considered to contain brines with sulphates, as well as carbonates and chlorides. To understand their internal structure and to evaluate the presence of a deep internal ocean, it is important to know the phase relation between water and brine mixtures [1]. Bloedite crystal structure consists of parallel layers of $MgO_2(H_2O)_4$ and $NaO_4(H_2O)_2$ octahedra, interconnected through SO_4 tetrahedra and hydrogen bonds [2]. This paper intends to investigate the high-pressure behavior of bloedite to determine the equation of state, the density evolution, as well as the dehydration conditions. Data were collected at ID-09 beamline, at ESRF (Grenoble, France). We used a diamond anvil cell with 300 micron diamond culet, Neon gas as pressure transmitting medium and ruby chip as pressure calibrant. The very large image-plate detector, Mar555, allowed to collect data of high quality from single crystals. Lattice parameters and reflections intensities were obtained by Crysalis software. SHELXL software was used to refine the structure at different pressures up to 12 GPa. Equation of state (EoS) of bloedite was determined with data collected up to 12 GPa and EOS-Fit program [2]. A second order Birch-Murnaghan EoS fit yields $V_0 = 495.6(9)$ Å^3 and $K_0 = 40.5(7)$ GPa, whereas a third order Birch-Murnaghan EoS fit yields $V_0 = 497.6(4)$ Å^3 , $K_0 = 34(1)$ GPa and K' = 5.8 (4) GPa^{-1}. The lattice parameters compressibilities are β_a = -0.0074 (4) GPa^{-1}; β_b= -0.0069 (4)GPa^{-1}; β_c = -0.0054 (2) GPa^{-1} with an anisotropic ratio of 1: 1.07: 1.37. The structure is more incompressible along the direction perpendicular to open sheet, than the other directions. The SO_4 tetrahedra are incompressible, K_{MgO6} octahedra is 90 GPa and K_{NaO6} octahedra is 42 GPa. No phase transitions were observed in the bloedite structure up to 12 GPa, who remained stable at very HP. Hydrogen bonds evolution were followed through the O_{donor}-$O_{acceptor}$ distance, whose configuration explained the large compressibility of *a* and *b* parameters with respect to *c* lattice parameter. The lack of strong structural rearrangement, essential to compensate the dehydration process, suggested that water remaineds in the structure of bloedite in the investigated P range.

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Syenitic Provinces in the São Francisco Craton, Brazil

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The Paleoproterozoic in the Bahia State, Brazil, is characterized by the generation and emplacement of varius syenite bodies. The mainly occour in two mobile belts that represent parte of the basemente of the São Francisco Craton. These mobile belts are: (i) the Salvador-Curaçá mobile belt (SCMB), located in te eastern parte of the state, and (ii) the Urantdi-Paratinga mobile belt (UPMB), in the western part. Both are characterized by the emplacement of alcali-syenitic, potassic to ultrapotassic rocks, during the late stages of the stabilitaztion of these mobile belts, which occurred between 2.1 and 2.0 Ga. However, in the east parte the syenite is placed as tabular bodies and shows gneissic texture, while in the west parte they are related to pull-part system and developt only magmatic textures. The UMPB syeinte occur as wide single batholith (6,000 km^2), the Guanambi Batholith (GB), dated 2.05±0.02 Ga (U-Pb age). In the GB two main domins were recognized; (i) multipe intrusions (about 92% of the batholith), and (ii) late intrusions. Both have composiiton from syenite to mafic syenite towards monzonite. The U-Pb data show that the difference between the empacement of late intrusions was less them 5 Ma. The Eastern Bahia State, the SCMB syenite consist mainly of four massifs, discontinuously disposed. From north to south occur the following bodies: Itiúba (1800 km^2, 2.00±0.03 Ga, Pb/Pb age), Santanápolis (180 km^2, 2.10±0.04 Ga, U-Pb age), São Felix (32 km^2, 2.09±0.01 Ga, Pb-Pb age) and Anuri (70 km^2, 2.10±0.020 Ga U-Pb age). All intrude both gneiss-migmatitic and granulitic terrains. These syenite, despite the mobile belt in which they occur, show the same petrographic characteristics. They are leucocratic, porphyritic, mainly composed of perthitic alkali-feldspar, diopside, hornblend, phlogopite and biotite, ilmenite anda magnetite. In the syenites was found lamprophiric dykes (minette). Geochemical data indicate theat all these syenites are SiO_2-sturated to oversatured, alkalic to sub-alkalic and metaluminous. The K_2O/Na_2O ratios is always greater tham the unity, being higher in mafic terms. In some cases, these mafic terms can be classified as ultrapotassic. Ba (up to 8,0000 ppm), Sr (up to 6,000 ppm) and Rb (up to 940 ppm) are strongly enriched in these rocks. Cr (from 50 to 700 ppm), Ni (from 80 to 270) and Mg# (form 0.20 to 0.77) are reltively high form common syentic rocks. Chrondite-normalised REE patterns show strongely fractionated LREE with a small negative Eu anomaly, $\varepsilon_{Nd(t)}$ range from -10 to 0 (SCMB), and -11 to -7 (UPMB) and Sr_i values are around 0.705. From those data, we can concluded that the Paleoproterozoic was a propicius time form the generation of syenitic rocks in these two mobile belts of the Bahia State, independely from the tectonic regime. The syenitic result probably from fractionated crystallizaton of a lamprophiric magma, the later gernerated buy melting of Paleoproterozoic enriche mantle.

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