08.4-11 STRUCTURAL DISORDER AND COMPOSITIONAL ORDER IN AIKINITE AND KRUPKAITE. By A. Pring, South Australian Museum, Adelaide, South Australia.

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The bismuthinite-krupkaite-aikinite series (BiuS6-PbCuBi₃S6-Pb₂Cu₂Bi₂S₆) contains many highly ordered discrete phases at intermediate compositions. The structures of the intermediate minerals are supercells derived from the ordered intergrowth of stoichiometricly distinct ribbons of bismuthinite, krupkaite and aikinite. In sharp contrast to highly ordered intermediates, large compositional fields, ascribed to solid solution, have been reported for askinite $(Pb_{2-x}Cu_{2-x}Bi_{2+x}S_6, 0.0xx < 0.34)$ and krupkaite $(Pb_{1-x}Cu_{1-x}Bi_{3+x}S_6 - 0.13 < x < 0.14)$ (D.C. Harris & T.C. Chen, Can. Mineral., 1976, $\frac{14}{1}$, 194-205). The present study by high resolution electron microscopy has revealed extensive disorder in natural aikinites and krupkaites due to the intergrowth of narrow ribbons (-10A) of krupkaite in aikinite and aikinite and bismuthinite in krupkaite. In addition to the intergrowth of individual ribbons, crystals were also found to contain small domains of the well ordered intermediate minerals hammerite ($Pb_4Cu_4Bi_8S_{15}$) and friedrichite (Pb₅Cu₅Bi₇S₁₅). No evidence of significant variation from ideal stoichiometry for end member phases was found and it is apparent that the disordered intergrowth of crystallographically discrete structural units rather than solid solution is the mechanism for compositional variation in natural aikinites and krupkaites.

08.4-12 ALUMINIUM SUBSTITUTION IN OPAL-A.

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The substitution of aluminium for silicon in the opal-A structure results in a shift in the position of the broad, prominent, low-angle peak in the opal-A X-ray diffraction pattern. There is an almost linear decrease of the 'd spacing' with increasing aluminium content, from about 4.0 Å for aluminium-free opal down to 3.7 Å for Si/Si+Al = 0.93. It is easiest to explain this observation if the opal-A structure is considered in terms of cation rather than anion interactions. Thus substituting aluminium for silicon reduces the repulsion between adjacent tetrahedra. These can then twist and cause the overall framework to 'collapse down'. As a result, the average periodicity distance within the structure ('d spacing') decreases with increasing aluminium content.

08.4-13 THE STRUCTURE OF MICROCRYSTALLINE STLICA MINERALS. By H.Graetsch*, O.W.Flörke* and G.Miehe**, *Institut für Mineralogie, Ruhr-Universität Bochum, FRG, **Institut für Kristallographie, Universität Frankfurt, FRG.

The crystal structure and microstructure of microcrystalline opal ranging from opal-CT to opal-C (nomenclature according to Jones and Segnit, J. Geol. Soc. Aust., 1971, 18, 57-68) and the fibrous microcrystalline quartz varieties length-fast chalcedony and length-slow quartzine as well as the recently discovered silica mineral moganite (Flörke, Flörke and Giese, Neues Jahrb. Mineral. Abh., 1984, 149, 325-336) have been investigated by x-ray powder diffractometry, transmission and scanning electron microscopy, infrared spectroscopy and thermal analyses. Chemical analyses revealed that the main impurity of these minerals is water ranging from 0.5 to 3.0 wt.% in chalcedony, quartzine and moganite and from 2 to 10 wt.% in opal-CT/C. Approximately half of the water content in chalcedony, quartzine and moganite is silanole group water located at the whole water content is molecular water. Opal-CT/C, chalcedony and quartzine are characterized by small crystallite size, typically in the range from 10 to 50 nm, and high densities of planar defects. Consequently the diffraction patterns exhibit broadened reflections, diffuse intensities and also weak additional reflections. The structure of opal-CT and -C can best be described as an intergrowth of domains of cristobalitic and tridymitic or domains of cristopalitic and tridymitted stacking sequences with varying volume ratio, number of stacking faults and distribution of domain walls. The difference to noncrystalline opal-A seems to be only gradual, with decreasing coherent scattering domains and increasing in structural disorder. In chalcedony and quartzine the planar defects are twin boundaries between right- and left-handed quartz ries between right- and left-handed quartz lamellae, twinned according to the Brazil law. These domain boundaries have a structural arrangement similar to moganite. The crystal structure of moganite is presented. It can be described as being built up by periodically alternating 1011 lattice plane slices of right-and left-handed quartz, i.e. a systematic Brazil twinning in cell dimension scale. The structure of moganite is a new structure type for AB₂ compounds. It represents an improved model for the Brazil twin boundaries in quartz as e.g. in the so-called Brewster-bands in amethyst.