08.4-11   STRUCTURAL DISORDER AND COMPOSITIONAL
ORDER IN AIKINITE AND KRUPKAITE. By A. Pring, South
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The bismuthinite-krupkaite-aikinite series (Bi_4S_6-
$PbCuBi_3S_6$-$Pb_2Cu_2Bi_2S_6$) 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
aikinite ($Pb_{2-x}Cu_{2-x}Bi_{2+x}S_6$, $0.0<x<0.34$) 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, 14, 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 ($Pb_5Cu_5Bi_7S_{15}$). No evidence of
significant variation from ideal stoichiometry for end
member phases was found and it is apparent that the
disordered intergrowth of crystallographiclly 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.
By J.A. Webb, B.L. Finlayson and T.R. Finlayson,
Department of Geology, La Trobe University, Australia,
Department of Geography, Melbourne University,
Australia and Department of Physics, Monash University,
Australia.

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
SILICA MINERALS. By H.Graetsch*, O.W.Flörke*
and G.Miehe**, *Institut für Mineralogie, Ruhr-
Universität Bochum, FRG, **Institut für
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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 varie-
ties 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 chalce-
dony, 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
structural defects, while in opal-CT/C nearly
the whole water content is molecular water.
Opal-CT/C, chalcedony and quartzine are cha-
racterized by small crystallite size, typically
in the range from 10 to 50 nm, and high densi-
ties of planar defects. Consequently the
diffraction patterns exhibit broadened reflec-
tions, diffuse intensities and also weak addi-
tional reflections. The structure of opal-CT
and -C can best be described as an intergrowth
of domains of cristobalitic and tridymitic
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 decrea-
sing coherent scattering domains and increasing
in structural disorder. In chalcedony and
quartzine the planar defects are twin bounda-
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 AB_2 compounds. It represents an improved
model for the Brazil twin boundaries in quartz
as e.g. in the so-called Brewster-bands in
amethyst.