are enstatite, and olivine, both of variable composition, bytownite, tridymite, whitlockite, ilmenite, chromite, schreibersite, kamacite, taenite and troilite. Although this assemblage indicates disequilibrium, the high Ca–low Na content of stanfieldite is reflected in the composition of the plagioclase.

Stanfieldite has been found in the following pallasites: Santa Rosalia, Albin, Finmarken, Imilac, Mt. Vernon and Newport. The mineral in the pallasites is practically Fe-free, with Mg substituting for most of the Fe in the above formula. The *x*-ray powder patterns are practically identical except for slightly smaller *d* spacings due to this substitution.

THE CRYSTAL STRUCTURE OF KERNITE $Na_2B_4O_6(OH)_2 \cdot 3H_2O$

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Kernite is monoclinic, space group $P2_1/c$ with cell dimensions a = 7.0172 (±.0002) Å, b = 9.1582 (±.0002), c = 15.6774 (±.0005) and β = 108.861° (±.002°). The crystal structure has been solved using the symbolic addition method of Karle & Karle. The *x*-ray diffraction intensities were measured using a single-crystal diffractometer and Cu*Kα* radiation monochromatized with a balanced pair of nickel and cobalt filters. All atoms including hydrogen have been located. The final *R*-factor with anisotropic thermal motion is .043. The structure consists of infinite chains, two per unit cell, of the borate polyanion $[B_4O_6(OH)_2]_n^{-2n}$ parallel to the *b*-axis.

These chains are composed of six-membered rings containing one boron-oxygen triangle and two boron-oxygen tetrahedra. The rings are linked through commonly shared boron-oxygen tetrahedra. The linkage between chains in the *c*-axis direction is through hydrogen bonds involving half of the $(\overline{OH})$ groups. The remaining $(\overline{OH})$ groups are not involved in any apparent hydrogen bonding. The cross bonding in the *a* axis direction is through hydrated sodium ions. One sodium ion is coordinated by $4O^{-2}$, OH^- and H_2O in a distorted octahedral arrangement, while the other is unusual in having only five coordinating neighbours, $2O^{-2}$ and $3H_2O$. Kernite can be formed from borax, $(Na_2B_4O_6(OH)_2 \cdot 8H_2O)$ by dehydration in agreement with Christ's rules, but the process seems to require breaking some B—O bonds.

FLUID CONTENTS OF APATITES FROM THE OKA COMPLEX, QUEBEC, AND POSSIBLE GENETIC IMPLICATIONS

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Apatite is common in rocks of the Oka complex or related to it. It occurs as anhedral to prismatic to definitely acicular crystals. It often contains inclusions of calcite, and also fluid inclusions. The latter are highly variable in shape, e.g. from acicular to perfectly spherical; changes in shape and in abundance, connected with the nature of the host-rock, are observed. Fluid inclusions often exhibit the following features: (1) when of elongated shape, elongation is nearly always parallel to the *c* axis; (2) inclusions are often preferentially located in families of planes parallel to prismatic faces; and (3) not infrequently, inclusions are preferentially located in the inner part of the crystals. Such inclusions are regarded as being of primary origin. Crystalline phases are often present in the fluid inclusions.

Some apatite contains as much as 1.2% by weight of fluids, as shown by heating from room temperature to 1,000 °C. Among the gases released, the most abundant compound is CO_2 (up to 97%), followed by CO (up to 18%). Hydrogen and nitrogen are also present. Water is usually scarce. Hydrocarbons and traces of HCl are sometimes detected. Thermal analysis shows that release of the fluids often occurs in several distinct steps, at definite temperatures.

From the above results, and from experimental data published by other authors, it appears that the Oka apatites crystallized in the presence of fluid phases, at moderate temperatures. Variations in the shape of the fluid inclusions may reflect changes in the temperature of crystallization. Studied in conjunction with synthetic systems, apatite may thus become valuable as a geologic thermometer in the study of carbonatites.

PHOSPHATE–SULFATE MINERALIZATION AT THE WHITE MOUNTAIN ANDALUSITE DEPOSIT, MONO COUNTY, CALIFORNIA

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The White Mountain andalusite deposit is on a steep west-facing slope of the White Mountains, Mono County, California.

Andalusite occurs in a massive, north–south trending, dike-like body which is exposed along its strike for 2,500 feet and is 850 feet in width. A smaller body of andalusite occurs south of the main body at a lower elevation, and is believed to be a downward displaced segment of the main body.

The main andalusite body is bounded by both north- and east-trending faults. Due to intense hydrothermal alteration the amount of fault displacement and the relative ages of the different rock types are difficult to decipher. The main andalusite body is bordered on the east by quartz monzonite porphyry, on the west by hydrothermally altered sericite schist and metavolcanic rocks; and is overlain in part by a weakly foliated quartzite.

The main andalusite body consists of irregular, massive, milky quartz and andalusite, zones of quartz-topaz rock, and irregular zones consisting of phosphate and sulfate minerals and quartz. Diaspore, pyrophyllite, and rutile are predominant in hydrothermally altered areas adjacent to the andalusite-bearing rock.

The andalusite deposits suggest several phases of development, which include: pegmatitic, pneumatolytic, and finally hydrothermal alteration. In the pegmatitic stage of mineralization silica and alumina were introduced early, followed by fluorine and boron. This stage was followed by the introduction of phosphates and sulfates. Finally, minerals of complex composition and hydrothermally altered minerals developed within and adjacent to the main andalusite body.

ORE MINERAL RELATIONS IN THE CUYUNA SULFIDE DEPOSIT, MINNESOTA

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The Cuyuna sulfide deposit is located in south-central Aitkin County in an outlying area of the Cuyuna Iron Range, Minnesota.

The ore minerals of the deposit have been studied systematically by polished section methods. The principal ore minerals are pyrrhotite and pyrite, whereas magnetite and marcasite are subordinate. In addition, sphalerite, chalcopyrite, arsenopyrite, ilmenite, hematite, and goethite are present in minor quantities.

Four generations of pyrite have been recorded, namely, pyrite I, which is sedimentary or diagenetic; pyrite II, which is metamorphic; pyrite III formed directly