

Evidences of aqueous alteration in Dar al Gani 194 CO chondrite, and suggestion of its mechanism.

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The evidences of thermal metamorphism and aqueous alteration included in Dar al Gani 194 (DaG194) CO chondrite were studied in detail. And in this study, I tried to suggest a hypothesis about reaction process that have influence on several CO chondrites which located in shallow positions of their parent body.

Thermoluminescence (TL) sensitivity and Cathodoluminescence (CL) property indicated that the devitrification and recrystallization of chondrule mesostasis glasses had not progressed and DaG194 had not experienced higher temperature than 600C. DaG194 includes much water, therefore it would be expected that this chondrite keeps both of evidences which caused by thermal metamorphism and aqueous alteration in itself.

By observation made on SEM, it was shown that CAIs in DaG194 experienced aqueous alteration. Gehlenites in CAI were replaced by two kinds of minerals rich in Na, K or Na, Cl. The Na and K - bearing minerals located in the deep part of gehlenite and this suggested the aqueous solution reacted with gehlenite and replaced it deeply. As compared with this, the Na and Cl - bearing minerals distributes only on the surface of gehlenite. These minerals can come in contact. These observations suggest that two kinds of fluid which have various different conditions (pH, temperature, chemical composition, etc.) have been produced in this chondrite and these minerals have been precipitated from different fluids each other.

To clarify the conditions in which the secondary Na and Cl - bearing minerals were created, hydrothermal experiments were performed. Several materials were enclosed in containers with solution in which chlorine was included, and they were heated at 80C or at 200C for 144 hours.

The Na and Cl - bearing mineral, sodalite was produced by reaction of SiO₂-Al₂O₃ mixture and the solution including chlorine. Sodalite was created even in the solution in which Cl⁻ was included only tenth part of OH⁻. This means that by the fluid including chlorine, sodalite would have to be created on the gehlenite and the minerals include no chlorine, such as nepheline and analcime, would be never created. To create nepheline or analcime, a fluid including no chlorine is indispensable.

Therefore, to create both Na, K - bearing minerals and Na, Cl - bearing minerals, it is necessary that two kinds of fluids are produced in DaG194. One of these fluids has to include chlorine and the other one has to include no chlorine. It is impossible that both of these fluids are produced from ice, because of the proximity of two kinds of secondary minerals. Therefore, it is plausible that one of these fluids was produced by melting of ice and the other fluid was produced by dehydration of hydrous minerals at higher temperature.