

## Estimation of metamorphic temperature of NWA2129 CK-carbonaceous chondrite: Implications for the formation process

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CK chondrites differ from other carbonaceous chondrites in showing mineralogical and petrographical features suggesting thermal metamorphism. Olivine and pyroxene in CK chondrites are compositionally homogeneous as those in metamorphosed ordinary chondrites. Unlike ordinary chondrites, plagioclase is very heterogeneous in chemical composition and sizes of it are relatively large with no relation to the metamorphic degree estimated for the meteorite containing it. These unique features of the CK chondrite suggest that CK chondrites may have been formed through unique thermal processes that are not revealed until now.

In this study, NWA2129 CK4 chondrite was used to reveal the formation processes of CK chondrites by examining mineralogical and petrographical characteristics. Compositional distribution and crystal size distribution of plagioclase are investigated in a polished thin section (PTS). Metamorphic temperature of the CK chondrite was estimated by using pyroxene thermometer (Lindsley, 1983), olivine-spinel thermometer (Wlotzka, 2005) and plagioclase thermometer (J. V. Smith, 1972).

Chemical compositions of plagioclase are  $An_{45-65}$  and  $An_{90-100}$  in chondrules,  $An_{44-92}$  in inclusions and  $An_{26.1-99.6}$  in matrix. Na-rich and Ca-rich plagioclases make clasts and distribute separately in matrix. The size distribution of plagioclase crystals in matrix forms a normal-distribution as a whole although they vary considerably in chemical compositions. The result indicates that the compositional variation of plagioclase is independent of crystallization process and all plagioclases have crystallized at a same process. Clinopyroxene and orthopyroxene were found to contact directly to each other in the PTS. The temperatures estimated by using pyroxene thermometer (Lindsley, 1983) are 578 C for clinopyroxene and 593 C for orthopyroxene. The equilibration temperature between olivine and spinel that was estimated by using olivine-spinel thermometer (Wlotzka, 2005) is 471(31) C. The crystallization temperatures of plagioclase that were estimated by using plagioclase thermometer (J. V. Smith, 1972) are in the range from 700-1200 C. The estimated temperatures of the range from 500 to 700 C may correspond to metamorphic temperature in the parent body. However, it may be difficult to consider that metamorphic temperature in a parent body had attained to 1200 C, being a solidus temperature of plagioclase. Therefore, estimated crystallization temperatures of plagioclase at higher than 1000 C suggest that plagioclase crystallized in the planetesimal (about 10km radius), prior to accretion of planetesimals to the parent body.