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Single grain U-Pb ages of merrilite in the primitive achondrite Northwest Africa 6901.

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Northwest Africa (NWA) 6901 was recovered in the northwest Sahara in 2011 and is probably paired with NWA 2994 and NWA 3250. All three meteorites have recrystallized porphyroclastic to poikiloblastic textures, contain rare relict chondrules, and minerals that range in grain sizes from 0.04 to 1.6 mm. Furthermore they have O isotope compositions that fall within the compositional range of CR chondrites. NWA 2994 was originally classified as ungrouped chondrite, later it was suggested to belong to a group of extensively metamorphosed CR chondrites, called CR metachondrites [1]. The other two meteorites were classified as primitive achondrites.

NWA 6901 has large mm-sized olivines with kink-bands and curved grain boundaries decorated with small olivine neoblasts. Olivine is by far the most abundant mineral followed by low-Ca pyroxene, plagioclase, metal (kamacite, taenite and tetrataenite), sulfide, and chromite, high-Ca pyroxene and merrilite. Mafic minerals are rich in FeO with $Fa_{36.4}$ in olivine and $Fs_{29.0}$ in low-Ca pyroxene. Mineral compositions are homogeneous and have equilibrated at 2-pyroxene temperatures of 850 ˚C [2] and spinel-olivine temperatures of 700 ˚C [3]. These temperatures are similar to temperatures calculated for the primitive achondrite Acapulco [4] and imply a similar cooling history in this temperature interval.

We determined the U-Pb ages of single grains of merrilite by in situ analyses with a LA-ICP-MS (Element 2XR, ThermoFisher) equipped with an Excimer-Laser (UP 193, New Wave) at the Senckenberg Naturhistorischen Sammlungen Dresden. Preliminary results of the analyses of 5 grains result in an U-Pb age of 4563 $\pm$ 13 Ma for merrilite in NWA 6901. This age is within error consistent with model ages of two phosphate separates from the Acapulco meteorite of 4557 $\pm$ 2 Ma and 4555 $\pm$ 5 Ma as analyzed by thermal ionization mass spectrometry [5]. In addition, it overlaps with phosphate ages in H chondrites of petrologic types 4 and 5, ranging between 4563 Ma and 4556 Ma. However, it is significantly older than phosphate ages of highly equilibrated type 6 H chondrites ranging from 4521 Ma to 4506 Ma [6]. We conclude that NWA 6901 is unlikely to represent material from a highly metamorphosed interior portion of the CR chondrite parent body.

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