Study of meteorite 'Northwest Africa 14250' reveals composition of the early solar system

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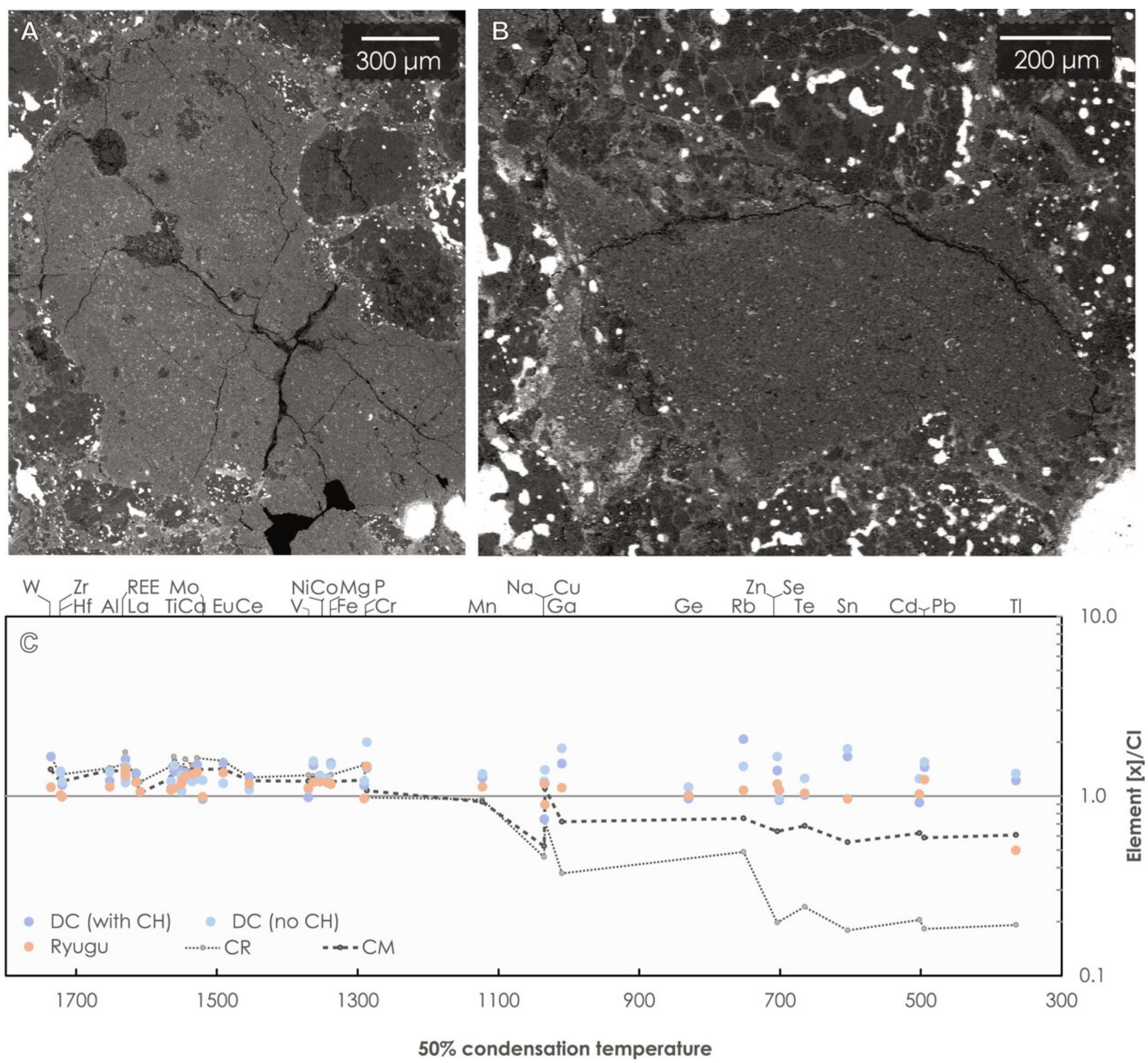

Petrology and composition of dark clasts from CR NWA 14250. Back scattered electron (BSE) images from (A) a large chondrule-containing clast and (B) a smaller clast without chondrules. (C) Averaged laser ablation inductively coupled plasma mass spectrometer analyses of the dark clast matrix show that the matrices of both clast types are chemically identical and resemble CI chondrites (y = 1) and Ryugu (orange) . Credit: *Science Advances* (2024). DOI: 10.1126/sciadv.adp1613

A multi-institutional team of planetary scientists has learned more about the early composition of the solar system by studying a meteorite named Northwest Africa 14250. In their study, published in the journal *Science Advances*, the group used a scanning tunneling microscope to learn more about the isotopic makeup of clasts inside the sample.

Prior research has suggested that the solar system began as nothing more than a cloud of dust. Thereafter, spinning of the cloud of material led to the formation of a disk with a center that eventually formed the sun. Outer parts of the disk eventually formed all the planets, moons, asteroids and comets.

Some of that early material, researchers believe, has remained essentially unchanged, orbiting out past the planets—that material is the Oort cloud, which is now made up mostly of chunks of ice and rock.

Such chunks, if they happen to make their way to Earth, are seen as comets. If they collide with the Earth, they are burned up in the atmosphere, making it difficult to study their makeup. But in recent years, scientists have found that sometimes, such comets collide with meteorites and materials can adhere. These meteorites, if they make their way to the Earth's surface, can be studied.

In this new effort, the research team analyzed one such meteorite named Northwest Africa 14250.

The team focused on clasts, which are clumps of materials found in meteorites that are not original meteorite material—they are foreign, and can be pieces of other meteorites or comets.

In studying the isotopic makeup of the clasts using a scanning tunneling microscope, the research team found them to be similar to clasts found in other meteorites that are known to originate beyond Neptune, and to those collected from the asteroid Ryugu.

Such findings, the team suggests, indicate that primordial material is common in the solar system and also that the protoplanetary disk was also likely quite uniform.

More information: Elishevah van Kooten et al, The nucleosynthetic fingerprint of the outermost protoplanetary disk and early Solar System dynamics, *Science Advances* (2024). DOI: 10.1126/sciadv.adp1613

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