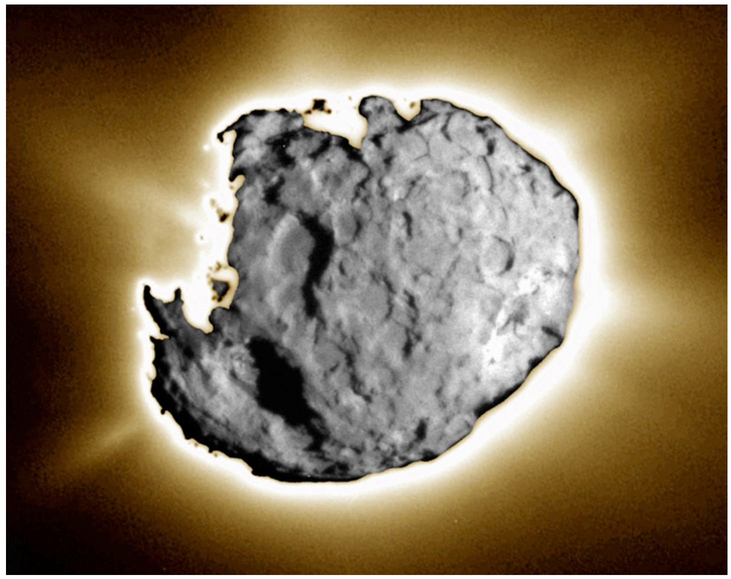
Press Release **Wednesday, February 29, 2012**

Analyses of a Tiny Comet Grain Date Jupiter's Formation



Particles from comet 81P/Wild 2 brought to Earth in 2006 by NASA's Stardust spacecraft were analyzed to determine when Jupiter formed in the solar system.
Image courtesy of NASA/JPL/Caltech.

Honolulu, HI – Particles from comet 81P/Wild 2 brought to Earth in 2006 by NASA's Stardust spacecraft indicate that Jupiter formed more than three million years after the formation of the first solids in our Solar System. The new finding helps test Solar System formation theories, which do not agree on the timing of Jupiter though it is certain the formation of this giant planet affected how materials moved, collided, and coalesced during the complex planet-forming process. Published in the February 1, 2012 issue of *The Astrophysical Journal Letters* are new results from laboratory analyses on a tiny fragment in one of the comet Wild 2 particles. Dr. Ryan Ogliore, a postdoctoral researcher at the Hawaii Institute of Geophysics and Planetology (HIGP, University of Hawaii) conducted the research with Drs. Gary Huss and Kazuhide Nagashima, also from HIGP, and colleagues from the University of California at Berkeley, University of Washington, and the Lawrence Berkeley National Laboratory.

Comets formed in the frigid Kuiper belt out beyond Neptune, but analyses of the Wild 2 samples showed that comets are composed of low-temperature and high-temperature materials that must have come from completely different environments. The team led by Ogliore analyzed a chondrule fragment known from previous research to have formed by high-temperature processes in the inner solar nebula—the cloud of gas and dust surrounding the infant Sun from which the planets formed. What could be more contradictory than high-temperature objects from the innermost regions near the Sun becoming the predominant dust components of an icy comet in the outer solar nebula? Ogliore and colleagues set out to determine when this grand, outward migration of materials occurred.

Using the University of Hawaii Cameca ims 1280 ion microprobe, the team measured magnesium isotopes (^{26}Mg is the decay product of the short-lived radioactive isotope ^{26}Al) and elemental aluminum (^{27}Al) in their sample to bracket its formation age. Aluminum-26, with a half-life of 730,000 years, is the extremely useful clock that cosmochemists use to date ancient events since the $^{26}Al/^{27}Al$ ratio varies in objects that formed at different times. Ogliore and team found no evidence for extinct ^{26}Al, meaning the cometary fragment formed after nearly all the ^{26}Al had decayed. Assuming homogenous distribution of ^{26}Al in at least the inner solar nebula, their results suggest the fragment formed at least three million years after the first solids formed. And this would have happened before Jupiter could have interfered, for theory says that a growing Jupiter would have accreted material so efficiently as to open a gap in the solar nebula. This gap would have posed a barrier to the outward migration of any material formed nearer the Sun than Jupiter's orbit, such as the fragment analyzed by Ogliore and team. The timing implies Jupiter formed more than three million years after the formation of the first solids in our Solar System. "We were surprised to find such a late-forming, high-temperature little rock in these cometary samples," said Dr. Ogliore. "That we are able to test theories about the formation time of Jupiter and consequently, the origins of our Solar System is really a testament to the importance of sample-return missions like Stardust."

###

This is a joint release by the Hawaii Institute of Geophysics and Planetology and the Planetary Science Research Discoveries online journal, www.psrd.hawaii.edu.

To view the PSRD summary, visit:
http://www.psrd.hawaii.edu/Feb12/chondrule-Wild2.html
or
http://www.psrd.hawaii.edu/Feb12/PSRD-chondrule-Wild2.pdf

To view the study, visit:
Ogliore, R. C., Huss, G. R., Nagashima, K., Butterworth, A. L., Gainsforth, Z., Stodolna, J., Westphal, A. J., Jowsiak, D., and Tyliszczak, T. (2012) Incorporation of a Late-forming Chondrule into Comet Wild 2, *The Astrophysical Journal Letters,* v. 745:L19-L23, doi:10.1088/2041-8205/745/2/L19.

Research Contact: Ryan Ogliore, Hawaii Institiue of Geophysics and Planetology. Email: ogliore@higp.hawaii.edu

Outreach Contact: Linda Martel, Planetary Science Research Discoveries, Hawaii Institute of Geophysics and Planetology, University of Hawaii at Manoa. Email: linda@higp.hawaii.edu

---

The School of Ocean and Earth Science and Technology at the University of Hawaii at Manoa was established by the Board of Regents of the University of Hawai‘i in 1988 in recognition of the need to realign and further strengthen the excellent education and research resources available within the University. SOEST brings together four academic departments, three research institutes, several federal cooperative programs, and support facilities of the highest quality in the nation to meet challenges in the ocean, earth and planetary sciences and technologies.

www.soest.hawaii.edu