Hypatia: former part of a very primitive solar system body?

GEORGY BELYANIN[1], JAN KRAMERS[1], MARCO ANDREOLI[2]

[1]Department of Geology, University of Johannesburg, South Africa; gabelyanin@uj.ac.za

[2]School of Geosciences, University of Witwatersrand, Johannesburg, South Africa

The stone "Hypatia" (about 30g) was found in 1996 by A. Barakat in southwest Egypt, in the area known for the occurrence of "Lybian Desert Glass", a product of surface melting. It consists predominantly of carbon, and is very hard and brittle. Diamond was first detected by XRD. An extraterrestrial origin was concluded from argon isotopes (Kramers et al., 2013) who also described diamonds to be in the ca 100 – 400 nm range and suggested that the object was part of a shocked comet nucleus. Avice et al. (2015) confirmed the extraterrestrial origin but, from N isotopes similar to those in graphite inclusions in iron meteorites, argued that Hypatia could well be from such an inclusion – then it would be part of a differentiated solar system object, not cometary material.

This study reports new Raman data obtained from a polished surface of Hypatia to better constrain physical conditions of formation for the stone's parent body. Amorphous and disordered carbon shows two main Raman bands that are diagnostic for the degree of disorder, the 'G' (graphite) band at c. 1590 cm-1 and the 'D' (disorder) band at c. 1350 cm-1. Diamond-like carbon has a single sharp band at 1330 cm-1. Comparison of the Hypatia Raman spectra with other solar system objects revealed its similarity with the least thermally processed bodies: stardust (81P/Wild2) and IDP's (Rotundi et al., 2008), UCAMM's (ultracarbonaceous Antarctic micrometeorites, Dobriča et al.,2011) and CI, CM carbonaceous chondrites (Quirico et al., 2005; Dobriča et al.,2011).

This evidence strongly suggests that the Hypatia stone was part of a very primitive (i.e. not thermally processed) solar system body. The comet analogy still stands.

References: *Allamandola, L.J., et al.,* 1987. Science, 237, 56-59. *Avice, G., et al.,* 2015. Earth Planet. Sci. Lett., 432, 243–253. *Dobrică, E., et al.,* 2011. Meteoritics & Planetary Science 46, 1363-137. *Kramers, J.D., et al.,* 2013. Earth Planet. Sci. Lett., 382, 21-31. *Quirico E. et al.,* 2005. Planetary and Space Science 53:1443–1448. *Rotundi A.,* 2008. Meteoritics & Planetary Science 43:367–397.