Discovering simultaneous sublimation activity of four primitive main-belt asteroids near perihelion

V. V. Busarev[1,2], S. I. Barabanov[2], V. B. Puzin[2]
[1]*Sternberg Astronomical Institute, Universitetskii pr. 13, Moscow, 119992 Russia;*
[2]*Institute of Astronomy, Russian Academy of Sciences, Pyatnitskaya ul. 48, Moscow, 109017 Russia*); E-mail*: busarev@sai.msu.ru*

Spectrophotometric observations of 145 Adeona, 704 Interamnia, 779 Nina, and 1474 Beira – asteroids of close primitive types – allowed us to detect spectral signs of their simultaneous sublimation activity near perihelion [1, 2]. Namely, maxima at ~0.35–0.60 μm in the reflectance spectra of Adeona, Interamnia, and Nina and at ~0.55–075 μm in the spectra of Beira have been registered and interpreted as results of scattering reflected from asteroid surface light in a temporal coma of sublimed micron-sized ice particles. We connect this activity with small heliocentric distances of the asteroids and, consequently, with a high insolation of their surface matter with absorbed water ice or presence on the bodies subsurface ice blocks. On the same asteroids, similar mineralogical absorption bands at 0.38, 0.44, and 0.67–0.71 μm were found. Examination of probable analogue samples allowed us to identify Fe^{3+} and Fe^{2+} in the material of these asteroids through the mentioned absorption bands. For analogues, we took powdered samples of carbonaceous chondrites Orgueil (CI), Mighei (CM2), Murchison (CM2), and Boriskino (CM2), as well as hydrosilicates of the serpentine group. A conclusion is made that the silicate component of the asteroids' surface material may be a mixture of hydrated and oxidized compounds, including oxides and hydroxides of bivalent and trivalent iron and carbonaceous-chondritic material. Nevertheless, the sublimation activity of Adeona, Interamnia, Nina, and Beira at high surface temperatures points to a substantial content of water ice in their material [1, 2]. This contradicts the previously existing notions on the C-type and similar asteroids as bodies containing water only in the bound state. Moreover, since the sublimation process simultaneously occurs on four primitive-type bodies at small heliocentric distances, we suppose that this phenomenon is common for the main-belt asteroids having low-temperature mineralogy.

References: [1] Busarev V. V. et al. (2015) Icarus, 262, 44-57. [2] Busarev V. V. et al. (2016) Solar Sys. Res, 50, 281-293.