EXPERIMENTAL FORMATION OF BASALTIC SPHERULES IN A CRUCIBLE AT HIGH TEMPERATURE AND ONE ATMOSPHERIC PRESSURE. J. K. Pati, M. Zahbi, S. Dwivedi, A. K. Singh, M. M. Dwivedi and A. K. Rai, Department of Earth and Planetary Sciences, Nehru Science Centre, University of Allahabad, Prayagraj-211002, Uttar Pradesh, India, National Centre of Experimental Mineralogy and Petrology, 14 Chatham Lines, University of Allahabad, Prayagraj-211002, Uttar Pradesh, India. Corresponding author (anujpcb@gmail.com)

Introduction: Spherules of varied size, shape and compositions occur in different geological environments and formed due to number of physical processes [1]. The majority of these spherules owes their origin either to volcanogenic, meteoritic impact or anthropogenic processes. However, the shapes (spherical, ovoid, dumbbell, teardrop, and disc) of these melt spherules originate from an initial spherical form due to its aerodynamic modification [2, 3]. For example, a tear drop spherule forms from a dumbbell shape which in turn is derived from a spherical form. In this study, a novel experimental set-up has been designed to generate various volcanogenic structures at high temperature (1200°C) under atmospheric pressure in a reducing environment.

Materials and methods: Five experiments in all were conducted using alkali olivine basalt over a rhyolite substrate in a graphite crucible placed snugly within an outer platinum (Pt) crucible covered with a Pt lid. The run durations were variable (10-30 minutes). The runs were quenched in air. The Pt lid was manually lifted after each experiment with a long-handle Pt-tipped tongue.

Results and Discussion: The tear drop-shaped (3.50 x 4.28 mm²; Fig.1A) basaltic spherule was found attached to the Pt lid with neck length (0.46 mm) and width (1.10 mm).

The experimentally formed tear drop-shaped spherule is morphologically similar to the basaltic impact melt spherule (1.09 x 2.01 mm²; Fig. 1B) from the Lonar crater, India [4] and the anthropogenic silicate spherules (0.61 x 1.02 mm²; Fig. 1C) collected from Prayagraj, India [1]. This is the first report of an experimentally formed tear drop-shaped basaltic spherule (± agglutinated form) within a crucible which suggests that the well accepted aerodynamic modification mechanism for the formation of tear drop-shaped spherule is equivocal.


Figure 1. Tear drop-shaped spherules of different origin. (a) Experimentally formed spherule of basaltic composition observed during the present study, (b) Impact melt spherule, Lonar crater, and (c) Silicate spherule of anthropogenic origin.