DEGASSING AND VOLATILE CONTENT OF L3 CHONDRITE ABA PANU

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Introduction: Planetesimals and meteorites contain volatile components within to be released later during accretion, differentiation, magmatic or impact processes. These gases make up the most part of early (secondary) atmosphere of terrestrial planets [1]. Content and proportion of these volatiles are usually derived from thermodynamic modeling [2], while experimental results are not seen often [3,4]. We have analyzed oridinary chondrites different types as a primitive material conserved from the solar nebula. Chondrites are generally believed to be the building blocks of the Earth and other rocky asteroids, planets and satellites. The chondrites are undifferentiated (i.e., unmelted) stony meteorite containing metal+sulfide+silicate. The ordinary (H, L, LL) chondrites constitute about 97% of all chondrites. Here we present the initial results on experimental degassing during annealing of L3 S4 W0 ordinary chondrite Aba Panu. The meteor is a fall, which detonation was observed over the Nigerian state of Oyo in April, 2018.

Methods: To conduct the experiments, a special instrument was designed at the Institute of Geochemistry and Analytical Chemistry RAS. The apparatus consist of system of quartz tubes filled with hydrogen, insulated chamber and control panel. Sample annealing was done as a series of experiments with set temperature between 200 and 800°C with 100°C step between them; after temperature was settled the volatile content in reactor was assessed by gas chromatography every 15 minutes for 1,5 hours. More detailed description of the experiment is presented in [5].

Results and discussion: The following volatile constituents were identified: H_2O, N_2, CO_2, CO, CH_4, H_2, and H_2S. The substances can be conditionally divided into macro- and microcomponents. H_2O, N_2, and CO_2 belong to the first group, their concentration varies in the range of 3–120 µg/g of sample; the remained ones are in the second group (the concentration varies within 0.1–0.9 µg/g).

Combining all profiles at different temperatures for individual volatile results in time-temperature-concentration diagram, presented as a heat contour (fig. 1).

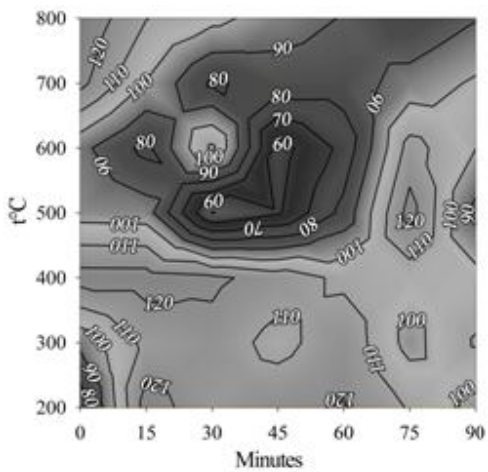

Figure 1. Heat contour of H_2O concentration (mg/g sample) versus time-temperature from degassing of Aba Panu

Observed change in concentration indicates chemical behaviour and possible form of accumulation within meteorite matrix. The following conclusions can be made: the main products of thermal meteorite outgassing are CO_2, N_2, and H_2O, where the first two behave rather inertly. However, with an increase in temperature and H_2 content, products of reducing reactions, such as CO, CH_4, and H_2S, also begin to form.

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References:

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