EXPERIMENTAL STUDY OF L3 ABA PANU METEORITE'S DEGASSING.

Voropaev S.A.[1], Eliseev A.A.[2], Dushenko N.V.[1], Fedulov V.S.[1]

[1]V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Kosygina 19, Moscow; [2]Moscow State University, Leninskie Gory, 119991, Moscow, Russia. E-mail: voropaev@geokhi.ru

Introduction: The study of volatiles, in particular their degassing from a meteorites during heating, allows us to more specifically assess the composition of the gas reservoirs that formed the primary and secondary atmospheres of the terrestrial planets. For these purposes, we have developed an experimental device for the controlled heating, followed by quantitative measurement of the composition of the released gases (see for details [1]). The primary concentrations measured during such degassing can be assumed, with some degree of approximation, to be the juvenile concentrations of gases contained in meteorites and planetesimals. Such a systematic analysis of volatiles in meteorites allows us to expand the concept of the migration and distribution of gases in the protoplanetary disk at the formation time of asteroids of different types, before the beginning of planetary accretion.

Methods: In continuation of the ideas of the previous work [2], where the similarity with volatiles of LL5 Chelyabinsk chondrites was analyzed, we presents some results for L3 chondrite Aba Panu [3] received via Raman spectroscopy. Two-stage heating is used for degassing. Initially, the substance is annealed at 100 Celcius degrees until any traces of adsorbed earth gases completely disappear. Then, the temperature rises to a set value in the range of 200-800 Celcius degrees and remains constant for 90 minutes. Each 15 minutes the composition and quantity of the extrctred volatile components are evaluated on a gas chromatograph. At the end of degassing, the substance was examined on a Raman spectrometer Renischaw InVia Reflect System with laser length 785 nm and power 300 mWt.

Results and Discussion: The change in the abundance of major active volatiles over time is shown in Table 1 The minerals which compose the L3 Aba Panu (olivine, pyroxene, plagioclase etc.) are interacted with gases and new mineral formations are deposited in their place. Some kind of metasomatism arises: mineral' transformation and deposition occur simultaneously and the rock remains solid.

Table 1. Volatiles dynamics by the L3 Aba Panu degassing at two different temperatures – 400 and 800 °C

Gas, μg/g \ min	0	15	30	45	60	75	90
400 °C							
H2	0,3049	0,3431	0,3389	0,3126	0,2611	0,2298	0,1824
CO2	9,0058	8,8768	8,1043	7,3552	6,8001	6,5974	6,4280
CO	0,0480	0,0659	0,0569	0,0489	0,0493	0,0430	0,0424
H2O	124,4190	124,2515	122,0070	115,9770	107,5685	104,4530	103,5150
800 °C							
H2	0,6996	0,9290	0,6579	0,7749	0,6101	0,7131	0,6872
CO2	2,9529	3,7006	2,7478	2,4925	2,4090	2,3500	2,6607
CO	0,1927	0,2741	0,2740	0,2525	0,2469	0,2387	0,2386
H2O	128,3385	110,2820	103,0125	94,5705	89,4450	81,1035	89,4450

It is noticeable that water vapor is the most active agent and iron oxidation can be expected. So, a comparison of the Raman spectra of substances after heating shows the transformation of magnetite (Fe_3O_4): its undergo the following phase transitions with temperature increase [4] Fe_3O_4 -> γ-Fe_2O_3 (200 °C) -> α-Fe_2O_3 (400 °C), where maghemite (γ-Fe_2O_3) is transformed to hematite (α-Fe_2O_3) starts with 400 °C. Detailed analysis of the meteorite' minerals transformations during degassing will be presented at the following paper.

Acknowledgments: The study was supported by the grant from the Russian Science Foundation No. 21-17-00120, https://rscf.ru/project/21-17-00120.

References:

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