ERG CHECH 002 UNGROUPED ACHONDRITE – SYSTEMATIC RAMAN SPECTROSCOPY ON A UNIQUE METEORITE

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Introduction: Erg Chech 002 belongs to a unique group of achondrites which are characterized by a bulk rock composition that plots in the (trachy-) andesitic field on a Total Alkali vrs. Silica (TAS) diagram [1-3]. Erg Chech 002 was found in 2020 in the Erg Chech region of the Sahara Desert in Algeria (total mass > 40kg) and was proposed to be a likely fragment of a chondritic protoplanet which is over 4.5 billion years old [4-8]. Further known (trachy-) andesites are Almahata Sitta individuals MS-MU 011 / 035 / xxx, NWA 7325 / pairs, NWA 11119 / pairs, NWA 11575, GRA 06128/9 and the most recent find Erg Atouila 001, an albitite [1-8].

Project and results: First results of our studies on Erg Chech 002 have been reported in [8]. From this starting point we decided to extend our investigations to a larger sample set in order to be more representative: our pilot studies characterized Erg Chech 002 as being quite heterogeneous in terms of phase composition / mineralogy and also magnetic signature (susceptibility), the latter mainly reflecting the concentration of Fe-bearing phases. The (surface) morphology and mineralogy of the samples was pre-investigated by digital microscopy followed by detailed and systematic investigations with LASER Raman Spectroscopy (a large number of high resolution mappings) [see 9,10 for details]. Erg Chech 002 is characterized by a low shock degree. Only on a very few spots of fusion crust are present. Minor terrestrial alteration effects can be observed, such as oxidation of iron-sulfides (troilite?) or metals. On the untreated surface of our samples (individuals) carbonates of terrestrial original and typical desert (wind blown) quartz particles pinned in a number of small and typical cavities could be found.

Phase composition, new finds: in our earlier report we have summarized the results of pilot studies obtained on two samples [8]. More detailed and systematic investigations basically confirmed the general trend concerning the major and dominating phases, with significant variations in detail, however:

(1) Pyroxenes (Ca-rich and poor pyx, and members of the enstatite-ferrosilite solid solution), often in complex intergrowth geometry)
(2) Plagioclase / oligoclase, no maskelynite (no shock effects)

Minor and accessory phases, see also [8], amongst these:

(3) Chromite
(4) Merrilite
(5) Ti-oxides (rutile, anatase?)

Cristobalite could be clearly identified by Raman spectroscopy now, no other primary SiO_2 phases could be found (quartz is terrestrial, see above), see figure 1a. The carbon phase mineralogy appears to be quite complex and restricted to very few spots. The first finding of carbonates of definitely primary origin (formation related) – most likely symplectites in radial structures, namely calcite and/or aragonite – in pyroxene matrix is a further very striking result of our systematic investigations (figure 1b). More details will be reported in our eposter.

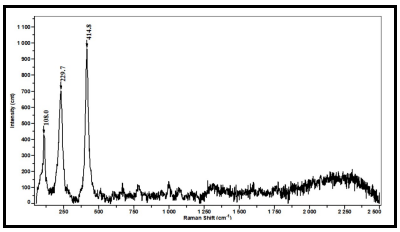

Fig. 1a.

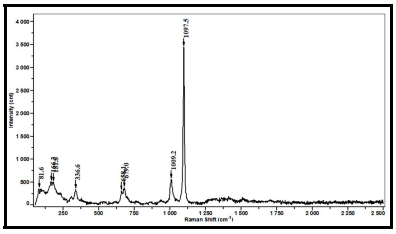

Fig. 1b.

References:

[1] Meteoritical Bulletin Database (05/2022): Almahata Sitta, NWA 7325/8409, NWA 11119 (and pairs), Erg Chech 002, NWA 11575, GRA 06128/9, Erg Atouila 001. [2] www.meteoritestudies.com. [3] Bischoff A. et al., 2014. PNAS 111, pp12689. [4] Barrat J.A.,et al., 2021. PNAS 118/11. [5] Mikouchi T., Zolensky M.F., 2021. LPSC, #2457. [6] Nicklas R.W., et al., 2021. LPSC, #1074. [7] Carpenter P.K., et al., 2021. LPSC, #2205. [8] Hoffmann V.H. et al., 2021. NIPR Antarct. Meteor., # OAP08, and refs herein. [9] Hoffmann V.H., et al. 2022a. Inter. Mineral. Congress. [10] Hoffmann V.H., et al. 2022b. Inter. Mineral. Congress.