PRESOLAR GRAINS IN BENNU: CONSTRAINTS FROM C AND N ISOTOPIC COMPOSITIONS.

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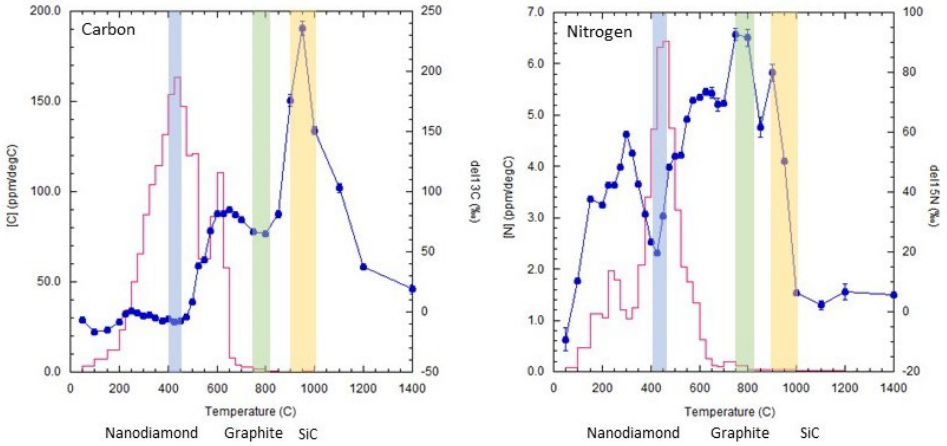
Introduction: Primitive chondrites, including CI and CM types, are known to contain a rich variety of presolar grains that were seeded into the protoplanetary disk from neighboring stars and stellar objects prior to aggregation into asteroidal parent bodies [1]. Stepped combustion using the FINESSE instrument at the Open University (OU) was employed to determine whether material from Bennu contains populations of presolar grains similar to those of CI and CM chondrites as well as recently returned samples from Ryugu [2-4].

Sample Analysis and Results: Two fine-grained aggregate samples (OREX-803058-0, 1.427 mg; OREX-803059-0, 1.170 mg) were analysed by stepped combustion–isotope ratio mass spectrometry to determine the abundance, distribution and isotopic composition of C and N [5]. C- and N-bearing components were released by incremental heating under excess oxygen from 50˚C to 1400°C. The two samples had total C ~ 4.4 wt. % with $\delta^{13}C$ between +8 and +16 ‰ and 900–1200 ppm N with $\delta^{15}N$ between +44 and +72 ‰.

Discussion: The most abundant presolar grains in CI and CM carbonaceous chondrites are nanodiamonds; they host Xe-HL and have carbon and nitrogen isotopic compositions not completely distinguished from Solar System [6]. Presolar graphite and silicon carbide are also present with highly unusual carbon and nitrogen isotopic compositions characteristic of the astrophysical environments in which they condensed [7]. Because we analyzed whole-rock samples in which different components overlap in combustion temperature, our results did not display the extreme $\delta^{13}C$ and $\delta^{15}N$ values measured by *in situ* ion microprobe analyses. The figure shows the stepped combustion profiles from OREX-803058-0; the coloured bars indicate the combustion temperatures for nanodiamonds (blue), graphite (green), and silicon carbide (gold). It is clear from the pattern of maxima and minima in $\delta^{13}C$ and $\delta^{15}N$ that presolar grains were present in the sample, supporting previous observations [8].



The abundance and isotopic composition of xenon was also measured during the experiments, as an extra control to monitor the presence of presolar grains. Using combinations of end-member compositions for presolar grains found in astromaterials, simple and complex meteoritic organic molecules, and carbonates, we are able to model the relative abundances of nanodiamonds, graphite and SiC. Full results from the modelling will be presented at the conference, but preliminary runs indicate that Bennu has a higher complement of nanodiamonds than most CI and CM chondrites, enhancing its similarity to the Tagish Lake (C2-ungrouped) meteorite.

Acknowledgments: This material is based upon work supported by NASA under Contract NNM10AA11C issued through the New Frontiers Program. We are grateful to the entire OSIRIS-REx Team for making the return of samples from Bennu possible. We thank STFC for funding (grant ST/Y000188/1) to support this work.

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