Pb-U-Th ISOTOPIC EVOLUTION OF THE D`ORBIGNY ANGRITE. Jagoutz, E. [1], Jotter, R. [1], Varela, M. E. [2], Zartman R. [1], Kurat, G. [3] and Lugmair, G. W. [1] 1)Abteilung Kosmochemie, Max-Planck-Institut für Chemie, Postfach 3060, D-55020 Mainz, Germany, (jagoutz@mpch-mainz.mpg.de) (jotter@mpch-mainz.mpg.de) (rzart@yahoo.com) (lugmair@mpch-mainz.mpg.de) 2)CONICET-UNS, Departamento de Geología, San Juan 670 (8000) Bahía Blanca, Argentina, (evarela@criba.edu.ar) 3) Naturhistorisches Museum, Postfach 417, A-1014, Vienna, Austria, (gero.kurat@univie.ac.at)

Introduction :

D'Orbigny is the sixth angrite known up to now and the largest of this rare meteorite class [1]. Angrites are very old rocks with Pb-U-Th and Sm-Nd ages between 4.53 and 4.56 Ga [2,3,4] which also contained short-lived 142Nd, 53Cr and 244Pu [3-9]. However, high-precision Pb-U-Th data only exist for Angra dos Reis and LEW 86010 (4). Here we report the first results of our efforts to date D'Orbigny. In the future we plan to carry out a more detailed analysis of the Pb-U-Th, Rb-Sr, and Sm-Nd, as well as Mn and Cr, isotopic systematics on D'Orbigny. Comparing high resolution Pb-Pb ages obtained on pyroxenes:

	Age (Ma)	error (Ma)
ADOR	4557.8	0.42 (4)
LEW86010	4557.84	0.50 (4)
D'Orbigny	4559	1.1 (this study)

Petrography

D'Órbigny consist of two types of rocks with different textures: the back and front sides of the rock are compact and have a coarse-grained ophitic texture and envelop a highly porous coarse-grained rock [1,10]. Its major minerals are augite, olivine and anorthite. Anorthite is chemically pure An and forms plates which enclose olivine and augite and which are intergrown with olivine. Olivine is commonly zoned from about Fa20 to kirschsteinite, augite is zoned from En27Fs22Wo51 to En1Fs47Wo53. The Fe-rich interstitial mineralogy includes a silico-phosphate, ulvöspinel and sulfides. This meteorite is particular for its richness in hollow spheres and druses. The latter, much more abundant in the porous rock, are irregular, open spaces into which perfectly crystallized augites of prismatic habit and anorthite plates protrude.

Experimental Procedures:

The D'Orbigny meteorite was carefully crushed, and mineral separation was performed on the 100 to 200 µm size fraction. Anorthite and pyroxene concentrates (purity >99%) were obtained with a modified Franz magnetic separator using a stepwise increasing magnetic field, and the mineral grains were further purified by hand-picking under a binocular microscope. Prior to dissolution the minerals were intensively leached at room temperature in an ultrasonic vibrator to reduce terrestrial lead contamination. The anorthite was first etched with 3 n HCl, and subsequently with aqua regia. Following a similar treatment the pyroxene was additionally leached with 5% HF. The minerals were thoroughly rinsed with pure water after each leaching step. Digestion was achieved with a mixture of HF and HNO3, to which a 205Pb-235U-229Th spike was added. For anyone sample the same Teflon beaker was used in all subsequent operations to avoid additional handling. Our chemical separation followed well-established methods using anion exchange in small Teflon columns (50 µl resin volume). Pb was retained in 0.5 N HBr on DOWEX (AG-1 x 8) resin and eluted with 0.25 N HNO3. U was retained in 7.5 n HNO3 and collected by stripping off the column with

0.25 N HNO3 and H2O. The total procedural blank ranged between 2 and 5 pg Pb.

Results:

So far we have analysed two pyroxene and one anorthite separates for Pb isotopes. One of the pyroxene separates consisted of only the groundmass pyroxene while the other was comprised of the idiomorphic pyroxenes that grew inside the druse-like cavities. The latter pyroxene is considered to be 100% pure while the groundmass pyroxene might contain some inclusions.

The anorthite has a Pb isotopic composition close to that of terrestrial Pb, and indeed may be dominated by terrestrial Pb. However, the Pb concentration is lower than that reported for plagioclase from the other angrites (4) by a factor of nearly 5. The anorthite we analysed is pure Ca feldspar with no traces of alkalis, and, therefore, might be especially susceptible to Pb infiltration. This analysis will be repeated using a different chemical cleaning procedure on the mineral fraction before dissolution.

The groundmass pyroxene also has a very low Pb concentration (again, lower by about a factor of 5 when compared to LEW86010 or Angra dos Reis (4)). It contains 10.35 ppb U, 15.25 ppb Th, and 26.5 ppb Pb. The Pb-Pb model age is 4548 Ma with an uncertainty of 1.1 Ma. However, the U-Pb ages are not concordant, and the U/Pb ratio is about 30% too high to be in agreement with the Pb-Pb age. The discrepancy could be explained by either a gain in U or a loss of Pb, possibly caused either by terrestrial weathering or our severe leaching procedure. We must also consider that the groundmass pyroxene might contain some kirschsteinite, phosporsilicate, and plagioclase intergrowth. The relatively high common Pb—17% of the total Pb—suggests that there may be some plagioclase inclusions in the pyroxene.

The druse pyroxene, however, was very clean. It gives a Pb-Pb age of 4559 ± 1.1 Ma, with common Pb making up only about 3% of the total Pb. The U-Pb age as calculated is slightly discordant, but we are still in the process of calibrating the mixed spike being used in this study. Thus, until a more precise calibration is made, we cannot evaluate the apparent minor discrepancy between U-Pb and Pb-Pb ages with any degree of confidence.

Conclusions

Our preliminary analyses show D 'Orbgny to contain considerably less Pb and U than Angra dos Reis or LEW86010. Although the plagioclase appears to be dominated by terrestrial Pb, pyroxene separates give essentially the same Pb-Pb age as Angra dos Reis and LEW86010. D'Orbigny also contains less volatile elements and might, therefore, represent an earlier stage in the evolution of the angrites, perhaps detectable in its slightly older Pb-Pb age.

References:

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