THE MACROMOLECULAR CONSTITUTION OF THE CR CHONDRITES. **V. K. Pearson, M. A. Sephton and I. Gilmour.** Planetary and Space Sciences Research Institute, The Open University, Milton Keynes MK7 6AA, United Kingdom. (v.k.pearson@open.ac.uk)

Introduction: In contrast to the extensive mineralogical, petrographic and isotopic studies [1,2,3] that have been carried out on CR chondrites, their organic inventory remains poorly understood. The organic assemblage is dominated by a high molecular weight macromolecule. Pyrolysis studies, which involve the thermal dissociation of the macromolecule, have been used to determine the make-up of this component in other chondrites such as Murchison [4]. This study utilises similar pyrolysis methods in order to determine the macromolecular constitution of the CR chondrites Al Rais, Renazzo, EET87770 and Y790112.

Experimental: Whole rock meteorite samples were powdered and ultrasonically extracted with a 93:7 dichloromethane/methanol mixture (4×25min with additional 15 min centrifugation following each sonication), the extract removed and the residue dried. 25 mg of residue was loaded into a pre-cleaned quartz glass tube. The sample was flash pyrolysed at 610°C using a CDS 1000 pyroprobe (CDS Analytical, Oxford, PA) for 15 s in a flow of helium. The heating rate of pyrolysis was 20°C ms^{-1}. The interface was held at 260°C. The pyrolysate was analysed on an Agilent Technologies 5973 GCMS and the GC injector maintained at 250°C. GC conditions as in [4].

Results: Pyrolysates for all samples show the macromolecule to be composed of 1-2 ring, low molecular weight compounds, including both alkylated and hydroxylated forms (Al Rais is illustrated in Fig. 1) The dominant product was naphthalene and its alkyl derivatives. Generally, the products are consistent with reported pyrolysis fragments from CM and CI chondrites [5]. In addition, 3 and 4 ring (Al Rais and EET87770 only) compounds were detected. With the exception of benzonitrile, present in all samples but Renazzo, very few nitrogen compounds are evident. (Di)Benzothiophenes and their alkylated forms are found in all samples, with thiophene being present in only EET87770 where it elutes in the place of benzene.

Discussion: The presence of phenolic and hydroxylated species including fluorenone confirms their subjection to oxidising conditions during aqueous alteration inferred by petrographic data [1,2,3]. The occurrence of acetophenone and a high phenol content in Al Rais compared with other samples supports the proposal that it is the most aqueously altered sample [1]. Reports that CR chondrites have also experienced reducing conditions [2] are strengthened by the presence of 3-4 ring aromatics. Increased aromatisation induced by anhydrous heating will lead to the condensation of these high molecular weight compounds such as pyrene, particularly in Al Rais and EET87770. The 2:1-methylnaphthalene ratio indicates that the thermodynamically stable 2-methylnaphthalene predominates. This produces a sequence from high to low thermal alteration of Al Rais> EET87770> Y790112 >Renazzo.

Conclusion: 1. CR macromolecular material is composed of 1-4 ring compounds. 2. Oxidised species indicate their subjection to aqueous alteration. 3. High molecular weight fragments infer they have also undergone a period of thermal metamorphism.

References: [1] Weisberg M.K. *et al.* (1993) *GCA, 57*, 1567-1586. [2] Bishoff A. *et al.* (1993) *GCA, 57*, 1587-1603. [3] Kallemeyn G.W. and Wasson J.T. (1982) *GCA, 46*, 2217-2228. [4] Gilmour I. *et al.* (2001) *LPSC XXXII,* 1993. [5] Sephton M.A. *et al.* (1999) *GCA, 63*, 321-328.

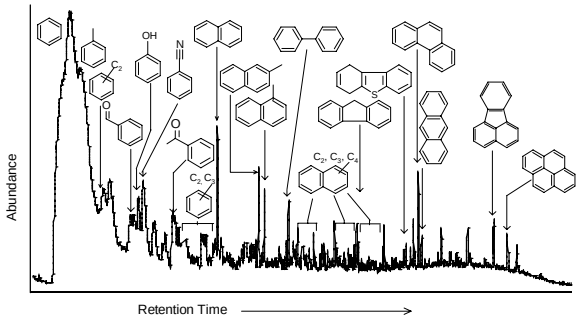

Figure 1 Total ion Chromatogram of solvent extracted Al Rais CR chondrite