THERMAL METAMORPHISM: RESULTS FROM A NEW TECHNIQUE FOR DETERMINING HOMOGENEITY OF MAJOR MINERALS IN ORDINARY CHONDRITES.

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Introduction: Since the introduction of petrologic type [1], homogeneity of olivine and low-Ca pyroxene has been used to determine the amount of thermal metamorphism an ordinary chondrite (OC) has experienced. The most common measure of homogeneity in chondrite classification is Percent Mean Deviation (PMD), defined by [2] as 100 x the average deviation in Fe wt % within a meteorite divided by the average Fe wt % of that meteorite. Scott [3] proposed Coefficient of Variance (CoV) as an alternate measure, because it uses standard deviation instead of average deviation. Most published values of PMD or CoV use tens to hundreds of data points to calculate homogeneity [e. g. 2,3]. We have developed a new technique that allows us to collect thousands to tens of thousands of points in a short amount of time, improving the robustness of our measurements, and allowing us to rapidly collect homogeneity and other compositional information from a suite of meteorites [4], and thereby build a unique database of the effects of thermal metamorphism in the ordinary chondrites.

Results: Table 1 shows the results for a suite of 5 L-chondrites. Olivine has an expected steady increase in homogeneity (indicated by decreasing PMD and CoV) with petrologic type. Low-Ca pyroxene is obviously less homogenous than olivine, and also shows a return to heterogeneity in one L4 chondrite. Further work will be done to determine whether this increase in heterogeneity is common in low-Ca pyroxene of the type 3.8-4 OCs. Type 4 chondrites are defined as having a PMD ≤ 5 in both olivine and low-Ca pyroxene [1]. This is not the case for low-Ca pyroxene in either of the type 4 chondrites examined thus far in the study, indicating that low-Ca pyroxene can be used to describe the degree of thermal metamorphism within type 4 OCs.

Pet. Type	Meteorite	Mineral	Average Fe wt %	CoV	PMD
3.6	LEW 87284	Olivine	15	52	42
3.7	ALH 77197	Olivine	18	7	5
3.8	ALH 85045	Olivine	17	11	7
4	ALH 85033	Olivine	17	9	6
4	Saratov DL	Olivine	16	7	4
4	Saratov LL	Olivine	16	6	4
3.6	LEW 87284	Pyroxene	9	26	20
3.7	ALH 77197	Pyroxene	9	23	19
3.8	ALH 85045	Pyroxene	10	11	8
4	ALH 85033	Pyroxene	8	27	20
4	Saratov DL	Pyroxene	11	10	7
4	Saratov LL	Pyroxene	10	11	8

Table 1. Composition and homogeneity in a sample suite of L-chondrites. Saratov DL and LL refer to a dark lithology and light lithology within the sample of Saratov examined for this study.

References: [1] Van Schmus W. R. and Wood J. A. (1967) *GCA* 31:747-765. [2] Dodd R. T. et al. (1967) *GCA* 31:921-951. [3] Soctt E. R. D. (1984) *Smithson. Contrib. Earth Sci*. 26:73-94. [4] Marsh C. A. et al. (2004) 35th LPSC, abs. #2033.