ACCRETION AND IMPACT HISTORIES OF OC PARENT BODIES CONSTRAINED BY PHOSPHATE PB-PB DATES, THERMAL AND NI-METAL MODELING.

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Introduction: A working timeline for the formation history of ordinary chondrites includes chondrule formation within 1-3 My after CAIs, followed by rapid accretion into small bodies. There remains debate, however, over the sizes and lifetimes of the chondrite parent bodies, as well as the importance of early impact processing, a record of which would be useful for understanding the formation history of neighboring Jupiter. Metallographic cooling rate studies find no relationship between cooling rates and metamorphic grade; interpreted to indicate wholesale disruption prior to reassembly of the OC parent bodies [1]. This is in conflict with thermochronometric studies that have argued for the long-term preservation (>1 Ga) of a concentrically zoned "onion shell" structure [2-3].

Techniques: New high precision TIMS ^{207}Pb-^{206}Pb data were obtained for phosphates of varying grain size from 10 previously unstudied OCs from all three groups and petrologic types 4-6. Model Pb-dates for L5/L6 span from 4534-4535 Ma/4505-4515 Ma. Data from a new H6 yields a range of dates correlating with grain size between 4505-4520 Ma reflecting variable closure times. All Type 4 samples studied (H,L,LL) yielded young dates (4500-4512 Ma). No LL chondrite Pb-dates were found to be correlated with metamorphic grade. The new and previously published [4-6] ^{207}Pb-^{206}Pb phosphate and metallographic data, are interpreted with a series of numerical models designed to simulate the thermal, ^{207}Pb-^{206}Pb in phosphate and Ni-in-metal evolution for a chondrite parent body that either remains intact or is disrupted by large scale impacts. Model tests rule out resetting the Pb system by impact heating, though early impacts prior to complete closure (400 °C) may be recorded.

Discussion: Assuming an onion shell scenario, both previously published and new ^{207}Pb-^{206}Pb phosphate data from H5-6/L5-6 are consistent with late accretion (2.20-2.25 Ma) in a 190-210 km diameter body, and that the H body was larger than the L parent body. All new as well as previously studied Type 4 samples record a history of very early impact processing, and yield cooling rates consistent with recent metallographic data [7]. Metallographic data from the H5-6 and L5-6 require a major planetary disruption prior to reaching 500 °C [2]. Both our new and previously produced ^{207}Pb-^{206}Pb in phosphate data consistently show that H6/L6s cooled more slowly than the H5/L5s. Model results suggest that this age relationship could still be preserved if a disruption occurred after both Type 5 and Type 6 layers fell below ~650 °C. Thus, each data type can be satisfied by an onion shell body that was disrupted after central temperatures reached 500-650 °C.

References: [1] Taylor J. et al. 1987. *Icarus* 69:1-13. [2] Trieloff M. et al. 2003. *Nature* 422:502-506. [3] Kleine T. et al. 2008. *EPSL* 270:106-118. [4] Amelin Y. et al. 2005. *GCA* 69:505-518 [5] Blinova A. et al. 2007. *M&PS* 42:1337-1350. [6] Gopel C. et al. 1994. *EPSL* 121:153-171. [7] Scott E. et al. 2014. *GCA* 136:13-37.