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Heterogeneity in the Main Group Pallasites – How many parent bodies? How many impactors?

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Historically, pallasite meteorites have been considered to be the remnants of the core-mantle boundary of a planetesimal, subsequently fragmented by a collision with a bolide sufficiently large to disaggregate the parent body[1]. More recently, increasingly complex models for pallasite formation have been suggested. For example, pallasite meteorites may in fact result from the addition of liquid Fe-Ni from the core of an impactor to an already differentiated ∼200-kilometre-radius body and that the destruction of the protoplanet was the result of subsequent impact(s) tens[2] to hundreds[3] of millions of years after the initial addition of liquid Fe-Ni metal. Moreover, textural and compositional evidence from the non-metal phases in main group pallasites also require a scenario more complicated than that originally envisaged, necessitating more than one parent body protoplanet and multiple impactors to destroy them[4][5].
There is considerable scope for variability in the size of the inferred parent body / bodies using the parameters in existing cooling models. This is coupled with a considerable amount of chemical heterogeneity in the silicate, oxide, sulphide and phosphate phases which constitute the non-metal components in these meteorites. Here we present preliminary results of a study which investigates whether or not current models underestimate the number of protoplanets involved in the formation of the main group pallasites. We combine the results of cooling models for protoplanets with textural observations and in situ measurements of silicate and oxide phases in main group pallasites to estimate the minimum number of parent bodies and bolides from which the main group pallasites were derived.

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