

Mineral inclusions and microstructure of carbon aggregates in ureilites Novo Urey and JAH 054

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Ureilites contain up to 6 wt.% C as interstitial aggregates in peridotite matrix along with sulfide and iron phases. They are scarcely studied by means of transmission electron microscopy. Here we performed detailed mineralogical and microstructural study of ureilites Novo Urei and JAH 054 with particular attention to identification of microinclusions in carbon aggregates. The samples were polished using Ar-ion milling to avoid contamination of sample surface during conventional polishing. Samples for TEM were prepared using FIB technique. In carbon aggregates we identified diamond, graphite and lonsdaleite. The crystals in Novo Urey (up to 20 μm) were much larger than in JAH 054 (<100 nm). Diamond zones in carbon aggregates do not contain any inclusions, whereas graphite-bearing zones contains inclusions of kamacite and Fe-Cr sulfide. We also investigated microinclusions in “smelted” zones of olivine and orthopyroxene recrystallization around carbon aggregates. These zones contain abundant voids and also sulfides, cohenite and possibly lawrencite. In JAH 054 most sulfide is replaced by anhydrite. Minor interstitial glass contains up to 85 wt % SiO_2 . Quenched SiO_2 crystals in this glass are represented by cristobalite (identified by Raman spectroscopy). New mineralogical findings support multistage origin of ureilite during stochastic impact events at least one of which was of catastrophic characters.

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