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Petrology and mineralogy of a new polymict ureilite Yamato 983890
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Introduction

Ureilites are the second largest group of achondrites. They are largely divided into two types: monomict and polymict. More than 90 % of ureilites are monomict ureilites, whereas polymict ureilites are relatively rare with only 23 approved meteorites [1]. Polymict ureilites are polymict breccias composed of lithic clasts and mineral fragments of various lithologies, some of which are unlike monomict ureilites [2-5]. Therefore, polymict ureilites provide valuable information about igneous and collisional processes on ureilite parent bodies, which cannot be extracted from monomict ureilites. Yamato (Y-) 983890 is a recently classified polymict ureilite [6]. In this study, we conducted careful petrographic observations on this new polymict ureilite.

Results and Discussions

Y-983890 consists of lithic clasts and mineral fragments which show a large variety of lithologies. Most of them are monomict ureilite-like materials, but some are not. The non-monomict ureilite-like materials include feldspathic clasts, dark clasts (carbonaceous chondrite-like), a chondrule/chondrite fragment, and others.

Monomict ureilite-like clasts/mineral fragments

The monomict ureilite-like clasts/mineral fragments in Y-983890 consist of coarse-grained (up to 1 mm) olivine and/or pyroxene with interstitial dark carbonaceous materials and/or graphite. Olivine has a chemical composition of Fo_{74-96} with high CaO (0.26-0.46 wt%) and Cr_2O_3 (0.47-0.91 wt%) contents. Pyroxene is mainly pigeonite ($En_{72-87}Wo_{5-11}$) and orthopyroxene ($En_{79-85}Wo_{2-5}$), but minor augite ($En_{55-64}Wo_{33-39}$) is also present. Chemical compositions of olivine and pyroxene, and Fe/Mg-Fe/Mn relations of olivine are consistent with those of monomict ureilites [4, 7].

Feldspathic clasts

Since monomict ureilites do not contain feldspar, lithic clasts containing feldspar are considered to be of non monomict-ureilite origin. We identified several distinct feldspathic clasts. They show different igneous textures and chemical compositions of constituent minerals (feldspar and pyroxene). Most feldspar has albitic compositions ($Ab_{80-87}Or_{3-8}$), but more An-rich one ($Ab_{55}Or_6$) is also present in a clast. Pyroxene is mostly augite ($En_{40-62}Wo_{21-38}$) and some clasts contain enstatite (En_{100}, $En_{67}Wo_4$) and pigeonite ($En_{38}Or_{15}$). These feldspathic clasts could be basaltic counterparts complementary to monomict ureilites (=ultramafic residues or cumulate).

Dark clasts (carbonaceous chondrite-like)

Y-983890 contains a lot of dark clasts. They mainly consist of fine-grained phyllosilicate-rich matrices with variable amounts of opaque minerals such as magnetite and sulfides. Magnetite occurs as spherical or framboidal grains, or as irregular aggregates. Sulfides such as pyrrhotite and pentlandite occur as euhedral crystals or anhedral polycrystalline aggregates. These dark clasts mineralogically resemble the matrices of CI carbonaceous chondrites.

Chondrule/chondrite fragment

A chondrule fragment was identified in Y-983890. It shows a barred olivine chondrule texture, consisting of barred olivine crystals (Fo_{79-82}) with interstitial devitrified mesostasis with albitic composition ($Ab_{83}Or_9$). The chemical composition of the olivine is in the range of that of H chondrite

The dark clasts and the chodrule/chondrite fragment are considered to be fragments of impactors collided with ureilite parent bodies.

References

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