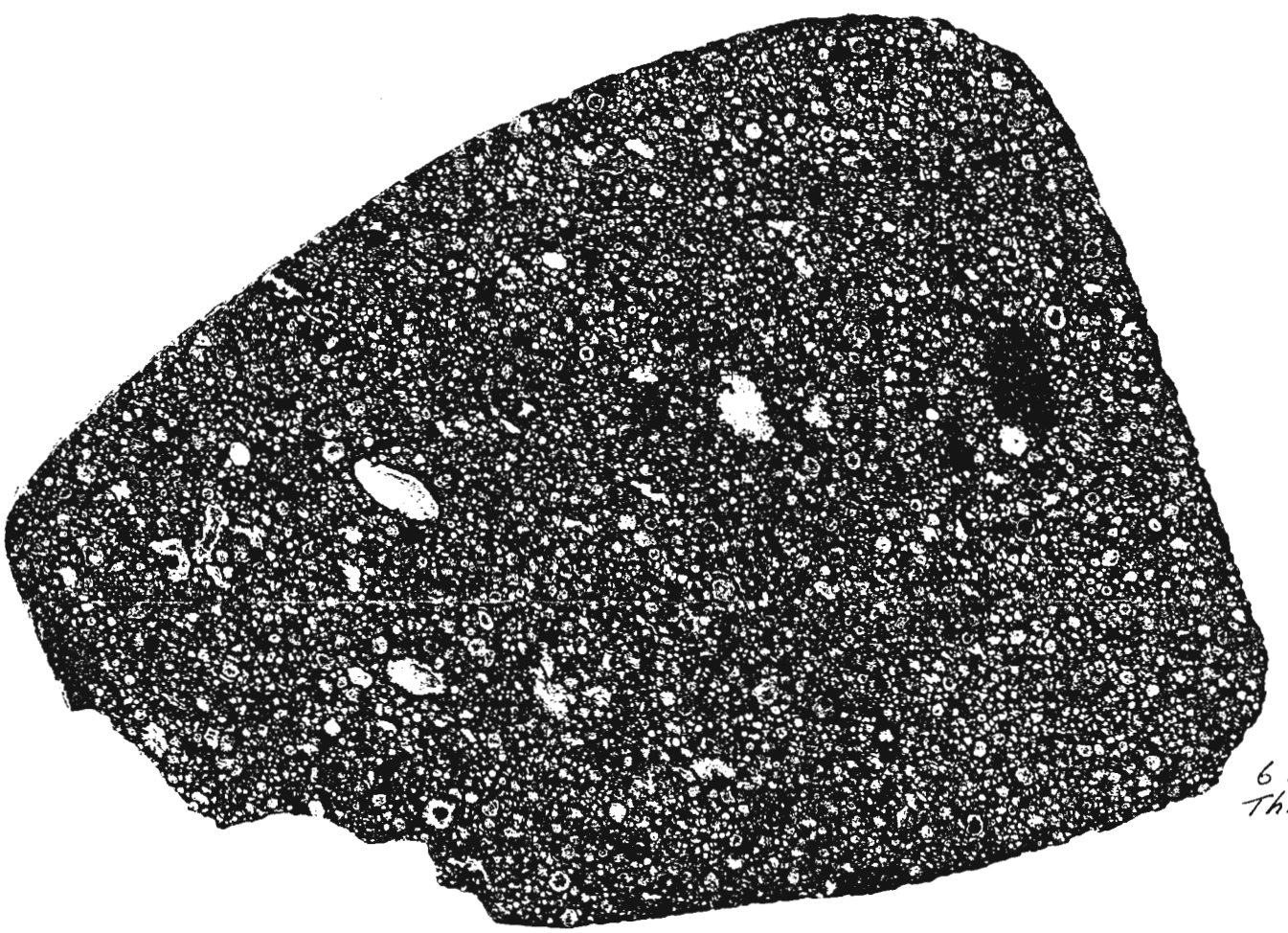
CARBONACEOUS
CHONDRITE CV3
Axtell,
McLennan County, Texas

Found 1943
DAVID NEW 264.3 g
Total known weight 6.2 kg —



6 mm
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OPAQUE MINERALS IN CAIS, AND CLASSIFICATION OF THE AXTELL (CV3) CHONDRITE

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Axtell is a new CV3 chondrite from Texas. Preliminary studies of its Ca-, Al-rich inclusions were reported by [1]. The mineralogy and chemical compositions of opaque minerals in four Axtell CAIs (AX-4, compact Type A; AX-5 and AX-7, Type B1; and AX 9, Type B2) are distinct from their analogs in other inclusions from CV3 chondrites. Metallic Ni-Fe (awaruite) is the dominant phase in opaque assemblages from Axtell inclusions, and occurs as well-rounded particles of sizes between ~1 and 20 μm. Their compositions (in atom %) are $Ni_{63.67}Fe_{31.33}Co_{2.3}$ in AX-4, AX-7 and AX-9, and $Ni_{74}Fe_{23}Co_2$ in AX-5. None of the awaruite grains contains measurable amounts (>200 ppm by weight) of the platinum-group elements analyzed for (Ru, W, Mo, Re, Os, Ir and Pt). With very few exceptions, the awaruite particles studied are surrounded by or intergrown with V-free magnetite (detection limit = 400 ppm). In contrast with Allende, the dominant sulfide phase in Axtell inclusions is troilite (Ni≤0.02 to 0.3%, by weight), pentlandite is scarce, occurring only sporadically as small grains associated with metallic FeNi (just a few particles of 5 to15 μm were found in AX-5, AX-4 and AX-7, and none in AX-9). Also, an isolated 10-μm grain of millerite (NiS; Fe=0.6 wt.%) has been identified in AX-5. Unlike Allende inclusions, Axtell CAIs do not contain sulfide veins. Two remarkably large PGE-rich sulfide grains have been recognized: one spherical, 12-μm particle in AX-4 (AX-4A, in melilite, close to the edge of the inclusion) and another irregularly shaped 25-μm grain in AX-9 (AX-9A, in melilite inside a spinel palisade). Study of the elemental distribution by wavelength-dispersive X-ray mapping and analysis and backscattered electron imaging suggests that these are single minerals and not multi-phase assemblages. After normalization to 100 wt.%, compositions (in atom %) of AX-4A (total elements analyzed=97.6 wt.%) and AX-9A (total=96.8 wt.%) are, respectively, $(Pt_{20.4}\ Ir_{13.8}\ Os_{13.1}\ Ru_{20.9}\ Ni_{0.9}\ Co_{0.1}\ Fe_{0.6})\ S_{29.8}$, and $(Pt_{11.9}\ Ir_{7.4}\ Os_{3.6}\ Ru_{23.2}\ Ni_{12.1}\ Co_{0.2}\ Fe_{30.6})\ S_{11.0}$. Microprobe analyses of chondrule olivines and low-Ca pyroxenes yield average Fa and Fs contents of 6.7 and 1.0 mol. %, respectively. These compositions suggest that Axtell is more similar to the CV3 chondrites of the reduced subgroup (average mol.% Fa=4.3 to 7.7 and Fs=2.8 to 4.7) than the oxidized ones (average mol.% Fa=7.6 to 11.7 and Fs=3.6 to 7.4 mol.%; [2]), although sampling biases (e.g. of amoeboid aggregates, more fayalitic, vs. chondrules, more Mg-rich; [3]) may result in large variations of the reported average composition of the olivines, and considerable overlap exists in the Fs contents of the low-Ca pyroxenes of both subgroups. The ambiguous taxonomic significance of olivine and pyroxene compositions in CV3 chondrites is exemplified by Bali which, despite being placed in the oxidized subgroup (on the basis of the similarity of its matrix/chondrule and magnetite/metal ratios, and abundance of Ni rich sulfides to those of other oxidized members), contains the most Fe-poor silicates of all the CV3 chondrites (Ol=$Fa_{4.4}$, low-Ca Px=$Fs_{1.0}$; [2]). Unfortunately, pervasive weathering of the matrix materials in Axtell has transformed all metal and sulfides into complex oxides and hydroxides, making difficult any direct comparison with opaque matrix materials from other CV3 chondrites. However, weathering of CAI metal and sulfides has been minimal. The abundance of metal and scarcity of Ni-rich sulfides in Axtell inclusions are more similar to those in the inclusions of the reduced CV3 chondrites, although additional knowledge of CAI materials in oxidized CV3s other than Allende is of critical importance to fully assess this interpretation.

REFERENCES: [1] Simon, S.B. et al. (1994): LPSC XXV: 1275-1276; [2] McSween H.Y. (1977): GCA 41: 1777-1790; [3] Greenwood J. and Steele I.M. (1976): GCA 40: 149-155.