presented. Why are meteorites not found on every blue ice field? What is the flow path from the accumulation zone to the emergent zone? Are terrestrial ages of specimens related primarily to time spent encased within the ice? How rapidly does weathering deteriorate the meteorites? Does weathering occur while the meteorite is covered by ice? How old is the ice in the ablation area? Are the meteorite accumulation zones in steady state, are they growing or are they just local deficit areas? How important is the sub-glacial topography to meteorite concentration? Is there a relationship between the isotopic composition of the emerging ice and meteorite terrestrial ages? Some of these questions are under investigation and others will be examined in the future. As the search for meteorites continues it seems practical to continue the investigation of the role of blue ice in the concentration of specimens. The periodic remeasurement of established stake networks such as the Allan Hills triangulation net will help by providing long term base line data.

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FREMDLINGE IN LEOVILLE AND ALLENDE CAI: CLUES TO POST-FORMATION COOLING AND ALTERATION

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Fremdlinge are perhaps the most exotic and least understood objects in CAI and their very existence places severe constraints regarding formation and cooling histories of the host CAI. Following the discovery and description of Willy[1], which appears to be an "Ur-Fremdling" or prototype for smaller Fremdlinge in CAI, we have begun a systematic study of CAI of different petrographic types to see if the Fremdlinge are consistent with a common mode of formation and differing degrees of reprocessing. Fifteen type B1, B2, and compact A CAI from Allende and Leoville were selected. The relative abundance of Fremdlinge varies dramatically among CAI, however some CAI of each type and from each meteorite contain abundant Fremdlinge. The range of phase assemblages and mineral chemistries of Fremdlinge from Allende and Leoville is very similar suggesting that the parent sources for Fremdlinge were quite similar. Chemically and texturally, Fremdlinge grade continuously from complex, heterogeneous Willy-like objects to altered, homogeneous metal nuggets. Some complex Fremdlinge like Willy were found in B1 CAI; none were observed in B2 CAI.

Heterogeneous Fremdlinge, such as Willy, are comprised predominantly of euhedral crystals of V-rich magnetite (V-mt) and metal and are surrounded with well developed rims of V-rich fassaite (V-fas). The metal is Ni-rich (~ 60 wt. %) and contains Co/Ni in cosmic abundance. Minor amounts of Pt and Ir are dissolved in the metal, while Os and Ru are present in discrete domains or nuggests which are also rich in Fe and Co. Minor phases include Fe, Ni- sulfide, apatite, and W and Mo-rich oxides and sulfides. The sulfide is not in equilibrium with the metal, having different Co/Ni, Cr/Ni, and V/Ni.

Less heterogeneous Fremdlinge are composed predominantly of metal and sulfide with minor Ca-phosphate. They contain significantly less V-mt than Willy-like Fremdlinge, but typically have at least a partial, apparently residual, V-fas rim. The Ni content of the metal is variable.

Metal partially formed by secondary reduction of pre-existing V-mt is depleted in Ni, Co and Pt. The sulfide appears to be in equilibrium with the metal, having the same Co/Ni, Cr/Ni, and V/Ni. The Pt content of metal appearing to be partially replaced by sulfide is higher than in Willy-like Fremdlinge. In extreme cases of Pt is exsolved into discrete Pt-Ir blebs. Os-Ru rich blebs of variable composition are also found. In some cases Fremdlinge are composed entirely of Fe-poor or Fe-absent Ni-Co-Pt metal and sulfide and may be residues of extreme oxidation or sulfidization of preexisting Ni-Fe.

In the least heterogeneous Fremdlinge the major phase is metal with minor Ca-phosphate. Fas rims and Mt are very rare and low in V. Sulfide may be present as a minor phase. The metal within individual Fremdlinge is homogeneous in composition with the refractory siderophiles dissolved in the Ni-Fe instead of present in discrete nuggets. In some CAI's these Fremdlinge occur with metal veins of similar composition radiating away from them suggesting that the metal was completely molten at one time.

All of the Fremdlinge have significant similarities suggesting common sources and formation mechanisms. Striking textural and compositional variations are, however, also readily apparent. We believe that these differences reflect the degree of reprocessing after incorporation into CAI of primary Fremdlinge typified by Willy. The basic question remains the conditions of formation of primary Fremdlinge, but it appears that textures and compositions of Fremdlinge may also help elucidate the cooling and metamorphic histories of CAI.

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SPECTROSCOPIC IDENTIFICATION OF PROBABLE PALLASITE PARENT BODIES

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Telescopic observations have recently revealed the existence of a class of asteroids whose surfaces show the spectral signature of abundant olivine. These objects were formerly grouped in the "R" class but are now separated into a new "A" class characterized by unusual broadband infrared colors (Veeder *et al.*). High-resolution IR spectra in the 0.8-2.6 micron wavelength region have been published for 246 Asporina (Cruikshank and Hartmann), 289 Nenetta (Cruikshank and Hartmann), and 446 Aeternitas (Bell *et al.*). All three objects show the distinctive deep multiple absorption band of olivine near 1.1 μm. The overall slope of the continuum suggests the presence of a metal component. This interpretation implies that the A-type asteroids are potential parent bodies of pallasites. We have conducted laboratory studies to investigate this hypothesis. Olivine grains of three sizes (fayalite content similar to main-group pallasites) were scattered on a roughened iron background to simulate the multiple scattering expected in a regolith derived from pallasite bedrock. IR spectra were obtained for a variety of iron/olivine ratios within each olivine particle size. No simulation using 1 mm olivine grains can reproduce the fine structure seen in the asteroid spectra; evidently the large olivine crystals found in pallasites do not survive regolith gardening. Simulations with 90-μm olivine grains provide excellent matches to the asteroids in band depth and shape, though continuum slopes indicate that the asteroidal metal phase has a more curved spectrum than does our artificial iron alloy. Apparent olivine content increases in the sequence Asporina-Aeternitas-Nenetta, from $\approx$ 30% to $\approx$ 40% to $\approx$ 70%. A third series of simulations employing a broad range of particle sizes $<$ 250 μm also provides acceptable matches with slightly higher olivine contents. (In the case of Nenetta a 100% olivine regolith may be consistent with the somewhat noisy data available.) These results fully confirm the previous interpretations (Cruikshank and Hartmann; Bell *et al.*) of A-type asteroids as having pallasite-like surface mineralogy. Because of the unusual spectral signature of olivine this identification is of high reliability and uniqueness, comparable to the generally accepted identification of Vesta as a basaltic achondrite parent (Gaffey). Since these objects are as large as 60 km in diameter and are apparently pallasitic over most of their surfaces, models in which pallasite formation is confined to small objects or restricted surface areas cannot explain them. The A-type asteroids are probably remnants of larger differentiated bodies which have been eroded down to the core/mantle interface zone where cumulate olivine crystals and nickel-iron metal coexist. The S-type asteroid 8 Flora has been shown to be a similar stripped core with an additional pyroxene component (Gaffey, in press). We speculate that S-type and A-type