WHY DID SO MANY POLYMICT EUCRITES LAND 
AND SURVIVE ONLY IN ANTARCTICA?

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Numerous polymict eucrite specimens (-35) have been recovered from Antarctica but very few comparable meteorites (6) are known from the rest of the world (2). The total mass of recovered basaltic achondrites (excluding diogenites) from Antarctica is, however, small. Antarctic recoveries (1969-1981) weigh less than 15 kg whereas the total known mass of other basaltic achondrites is over 150 kg (excluding diogenites) (1). Indeed, the mass of non-Antarctic polymict eucrites, using the definitions of (2), exceeds that of the Antarctic specimens. Because of the large number of Antarctic specimens available much detailed study has been done. As a result of these studies it seems clear that they are samples of a smaller number of meteorites (perhaps ~12), including eucrites and howardites. Other basaltic achondrites, most of which are falls, are usually represented by one stone, or by a small number of stones.

This contrast between the many small Antarctic basaltic achondrite specimens and the often large, non-Antarctic meteorites may be the result of several factors: (A) Fragmentation on the Antarctic ice may have broken up a few large specimens. (B) Non-Antarctic basaltic achondrite meteorites may be more coherent than many Antarctic specimens so that larger fragments survived atmospheric entry and impact on the earth intact. (C) "Soft landing" on the Antarctic ice may preserve fragile specimens better than "hard landing" elsewhere. Of these, (A) fragmentation on the ice seems to be relatively unimportant as many Antarctic specimens are nearly complete stones with fusion crust on most or all surfaces (3). If these specimens are paired then they must have landed as showers rather than as single stones. The predominance of shower samples in Antarctica also contrasts with non-Antarctic basaltic achondrites where meteorite showers represent less than 20% of observed falls (1). If the polymict eucrites were more friable than typical basaltic achondrites, then they probably disaggregated in the atmosphere and landed as showers rather than as single stones. The presence of many complete stones with fusion crust in the Antarctic collections that seem to be paired, supports this argument. Similarly, if polymict eucrites represent a friable lithology on their parent body, then hypotheses (C), a soft landing on the Antarctic ice or snow, may be essential for the preservation of the small, fairly delicate stones. Normal hard landing elsewhere, without the buffering effect of ice and snow, would totally fragment such friable achondrites.

Evidence that the Allan Hills and Yamato type polymict eucrites are more friable than other eucrites and howardites may also be had from their petrography. Most basaltic achondrites are regolith breccias and, therefore, resemble lunar regolith samples. The basaltic achondrites differ from most of the lunar regolith, however, as they were consolidated into strong rocks rather than being delicate, powdery materials. The achondrites appear to have suffered metamorphic recrystallization of the matrix that cemented the edges of clasts and grain boundaries together giving the rock much greater strength than typical lunar samples. This process appears to have affected almost all non-Antarctic eucrites and many howarditic fragments (4). Only one eucrite, Pasamonte, is essentially unmetamorphosed. Pasamonte also fell as a shower rather than a single stone (5). Meteorites derived from unmetamorphosed basaltic achondrite regolith may, therefore, be too friable to survive passage through the earth's atmosphere. Metamorphosed samples of the regolith, such as Juvinas, survive atmospheric passage better and are more commonly found.

Friable regolith seems more likely to be the dominant surface material of the basaltic achondrite parent (BAP) body than the metamorphosed material. Most samples of basaltic achondrites, therefore, represent rather specialized environ-
ments on the BAP body, whereas the rare Antarctic polymict eucrites are perhaps more representative of the uppermost crust on their parent body.

Because they are generally more delicate than most basaltic achondrites, Antarctic polymict eucrites require the special landing conditions of the Antarctic ice cap and snow for their preservation, and those that have landed elsewhere have generally disintegrated to small unrecognizable fragments upon impact. Other types of poorly consolidated meteorite breccias may, therefore, be more abundant in the Antarctic meteorite collections than elsewhere. Similarly, the ratio of preserved meteorite showers to solitary meteorites in the Antarctic collections is likely to be significantly higher.
