gneiss host to the dykes is also similarly reduced to xenolithic wisps and schlieren which merge completely into the younger gneiss. Similar effects are visible in coast outcrops around Ikerasagssuaq (Fig. 1). North of this inlet and around Amitsuarssugssuaq, the Amîtsoq gneisses, which for the most part are heavily migmatised with only rare Ameralik dykes, form linear strips within the Nûk gneisses, a relationship which suggests they have peeled off larger areas and are in an interrupted stage of incorporation into newer gneiss. Injected Nûk gneiss also occurs throughout the Buksefjorden region mapped so far. Original igneous textures survive only rarely: a hornblende granodiorite, for example, injected along a boundary between Amîtsoq gneiss and Malene amphibolite in east Amitsuarssugssuaq, retains igneous textures in the north but becomes gneissose with acid ptygma in the south. Much of the Nûk gneiss elsewhere in the Buksefjorden region contains enclaves of Amîtsoq gneiss (some clearly xenolithic) in various states of preservation. Modifications of the younger gneiss and its inclusions to new, banded gneisses have taken place in association with straight belt formation, for example in Amitsuarssugssuaq. This we regard as synchronous with the granulite facies metamorphism which has given a $^{207}Pb/^{206}Pb$ isochron of 2,850±100 Myr. (ref. 4).

The field evidence in the Buksefjorden region shows irrefutably that Nûk gneisses have been derived not only from injected material, but also by substantial remobilisation and incorporation of Amîtsoq gneiss. Our evidence is thus at variance with the conclusions drawn from isotope studies in the Godthåbsfjord region by Pankhurst *et al.*[3], that the Nûk gneisses "cannot have been derived by partial or complete melting of older rocks similar to the Amîtsoq gneisses." It has also been pointed out[4], that Sr and Pb isotope evidence suggests the ~ 2,800 Myr. granulite terrane in West Greenland does not represent a significant reworking of older crust (>100-200Myr.) such as the ~ 3,700 Myr. old gneisses of the Godthåb area, and they conclude that a significant addition of crustal material from an upper mantle source must have taken place in West Greenland between ~ 3,000–2,800 Myr. ago. The fact that Amîtsoq gneisses are common in the granulite facies terrane seen so far in Alangordlia and Sermilik (Fig. 1) does not in our view support this conclusion and we suggest, on the basis of field evidence for the late Archaean tectonometamorphic evolution of the Buksefjorden region to be published elsewhere, that events associated with the granulite facies metamorphism and later intrusion of the Qorqût granite suite[5] and related rocks may mark a stage as significant as the Nûk invasion postulated by McGregor in the addition of mantle-derived material to the Precambrian crust in West Greenland.

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Hardening of tungsten carbide by irradiation

We report here a remarkable degree of hardening produced in standard tool-making grades of sintered tungsten carbide in a cobalt matrix by irradiation with charged particles.

Flat, rectangular blocks of three different grades (Wimet H, N and CXT) were bombarded with up to 5 μA cm^{-2} of 32-MeV ^{3}He ions in the Birmingham University 150-cm cyclotron. Each block was partially screened by thick aluminium plate which could be moved to expose increasing areas at intervals of 15 min. Each sample was thus divided into 10 separate areas which had been bombarded for periods of 0 to 135 min. The maximum dose given was therefore 1.6×10^{17} ^{3}He ions cm^{-2} or 3×10^{11} rad. The ions penetrated to a depth of about 140 μm. The temperature of the block did not rise above 400° C during bombardment.

The hardness of each area after bombardment was measured using a Vickers Hardness testing machine, with a pyramidal diamond indentor, a load of 20 kg, and a 17-mm objective lens for measurement of the indentation.

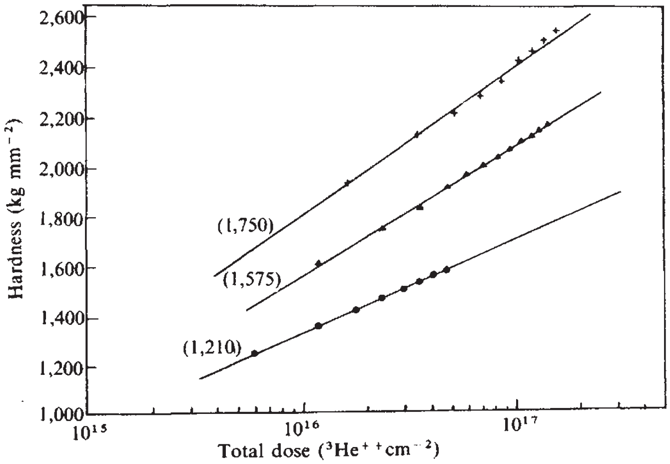

Fig. 1 Variation of Vickers hardness of three grades of Wickman Wimet tungsten carbide with bombardment of 32-MeV ^{3}He ions. The bracketed figures at the base of each line show the hardness of the unirradiated part of the sample. +, grade H; ▲, grade N; ●, grade CXT (Wickman Wimet grade).

The results are shown in Fig. 1. In the range within which measurements were made the hardness is a logarithmic function of dose, and about 30% increase in hardness was given to the hardest material by a dose of the order of 10^{17} ions cm^{-2}. At this density some 50 or so ions will pass through each atom of tungsten or of cobalt in the surface of the block and extensive damage to the crystal matrix of either material can be expected.

Further details and a more extensive series of measurements, together with measurements of other properties of the irradiated material will be published elsewhere.

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