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# AGE AND ORIGIN OF GNEISSES SOUTH OF AMERALIK, BETWEEN KANGIMUT-SANGMISSOQ AND QASIGIANGUIT.

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Gneisses which crop out along the southern coast of Ameralik between Kangimut-sangmissoq and Qasigianguit have been the subject of long-standing controversy cocerning their relationship to the early Archaean Amîtsoq gneisses of the Godthaab district.

On the basis of field observations, it has been argued that gneisses at Kangimut-sangmissoq and Qasigianguit are correlatives of the early Archaean Amitsoq gneisses. However, we believe that isotopic data on the K-s-Q gneisses are incompatible either with the direct correlation of K-s-Q and Amîtsoq gneisses or with the proposition that the K-s-Q gneisses could have been substantially derived from Amîtsoq gneisses by magmatic or metamorphic reworking during a later tectonothermal event.

Fig.1 shows a Sm-Nd isochron diagram on which are plotted the whole-rock analyses of six samples of the K-s-Q gneisses and eleven samples of Amitsoq gneisses. The K-s-Q gneisses define a 2825±125 Ma. isochron, with $\epsilon$ Nd(I) of +2.2 units. The Amîtsoq gneisses define a 3627±48 Ma. isochron, with $\epsilon$ Nd(I) of +1.7 units. The Sm-Nd isotopic data for the two rock-units are clearly quite distinct and do not permit any simple genetic relationship between the gneiss suites. The positive $\epsilon$ Nd(I) value demonstrates the lack of any identifiable component of ancient continental crustal Nd in the K-s-Q gneisses.

Fig.2 shows a Rb-Sr whole-rock isochron diagram for six samples of K-s-Q gneisses. These define a 2770±185 Ma. isochron, with an initial 87 Sr/86 Sr ratio of 0.70195±54. The K-s-Q gneisses are generally very depleted with respect to Rb. The six samples analysed for this work are those with the highest Rb concentrations. The Sr isotope evolution diagram (fig.3) shows the bulk-earth evolution line terminating at ⊗, the average Amîtsoq gneiss growth line, and the growth lines for the K-s-Q gneisses with the least and most radiogenic Sr. Average Amîtsoq gneiss at present erosion level had Sr far more radiogenic than K-s-Q gneisses at ca.2770 Ma. Such Amîtsoq gneisses could not be the parent material from which K-s-Q gneisses were formed. Indeed, almost all analysed Amîtsoq gneisses would have had 87 Sr/86 Sr ratios greater than ca.0.70195 at ca.2770 Ma. Models requiring very severe early Archaean Rb-depletion, followed by late Archaean re-introduction of Rb could be proposed to explain K-s-Q gneiss Sr isotope evolution in order to permit an early Archaean crustal residence age for the protoliths of the K-s-Q gneisses. However, such models cannot be made consistent with requirements for the Nd and Pb isotopic evolution, and they should therefore be discounted.

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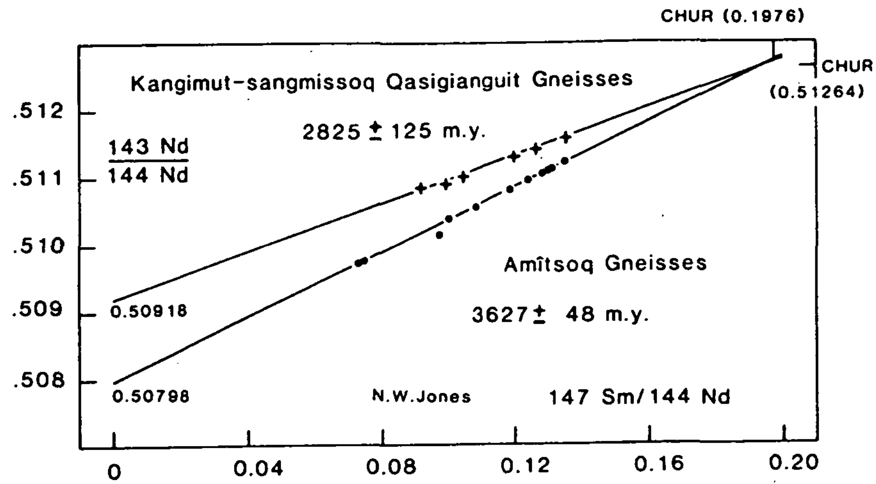


Fig.1. Sm-Nd isochron diagram for the Amitsoq and the Kangimut-sangmissoq & Qasigianguit gneisses.

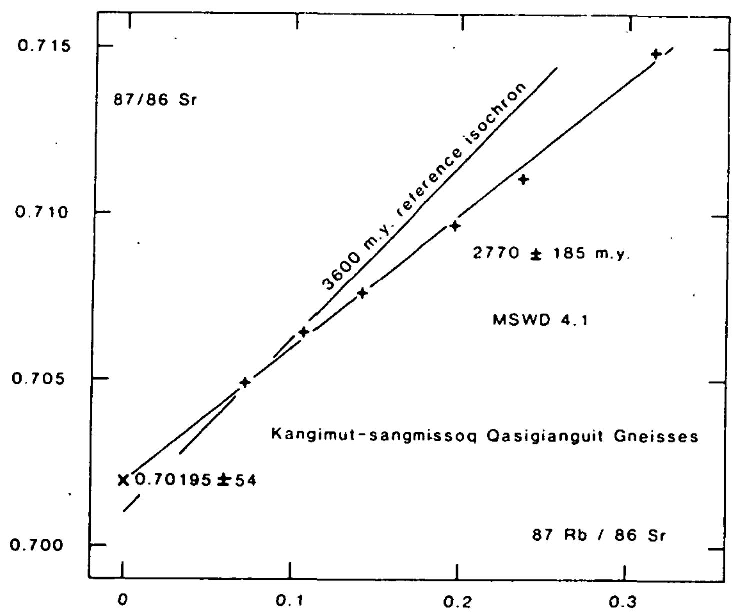


Fig.2. Rb-Sr isochron diagram for the Kangimut-sangmissoq & Qasigianguit gneisses.

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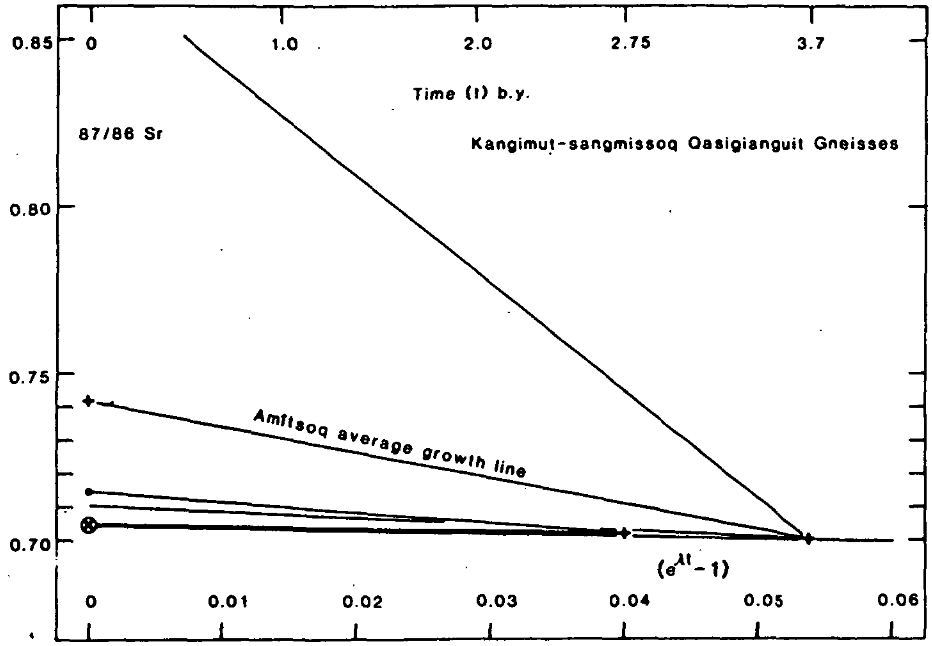


Fig.3. Sr isotope evolution diagram for the Kangimut-sangmissoq & Qasigianguit gneisses.

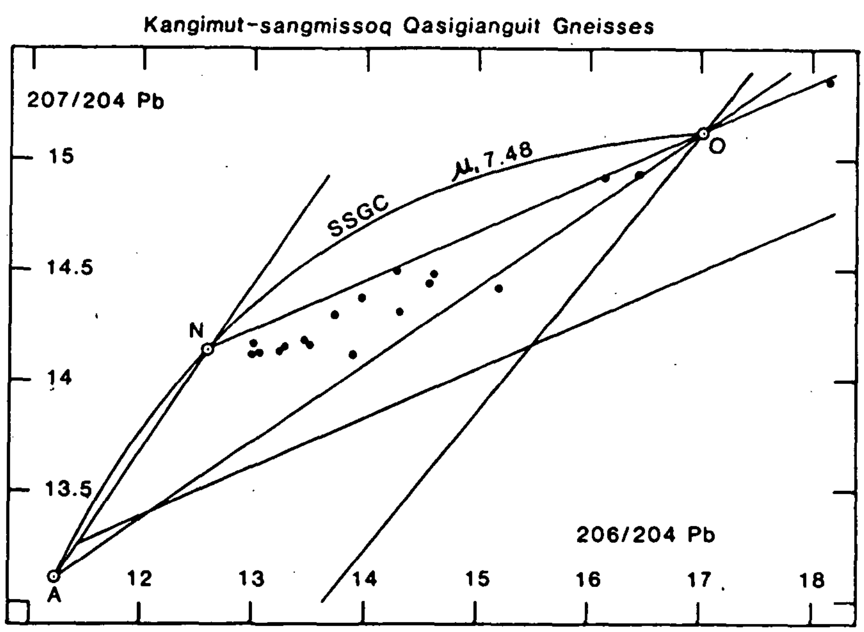


Fig.4. Pb isotope evolution diagram for the Kangimut-sangmissoq & Qasigianguit gneisses. For details of the interpretative framework see text and ref.(1).

Fig.4 is a Pb-Pb diagram in which the whole-rock isotopic analyses of eighteen K-s-Q gneisses are plotted. The Pb isotope data are interpreted within the framework of the crustal contamination model presented by Taylor et al. (1) for Nûk gneisses emplaced into or through Amîtsoq gneisses. ANO is the single-stage growth curve for a system with a $\mu_1$ value of 7.48. A is the model initial Pb of Amîtsoq gneisses at ca.3700 Ma., and N the model initial Pb of ca.2900 Ma. old Nûk gneisses which did not suffer contamination due to interaction with Amîtsoq gneisses. NO is the present-day isochron line occupied by uncontaminated Nûk gneisses. In the Godthaab district most of the late Archaean intrusive rocks show clear Pb isotopic evidence of interaction with Amîtsoq gneisses, i.e. their Pb isotopic analyses plot below NO. The K-s-Q gneisses also show such evidence for contamination with Amîtsoq-type Pb, although very few show severe contamination effects, and most have a very large proportion of their initial Pb from a juvenile source at ca. 2770 Ma. : i.e. they are generally less contaminated than most Nûk gneisses.

Two K-s-Q gneisses plot close to the extension of the present-day array of Amîtsoq gneiss Pb data (AO in fig.4.), but much closer to O than the analysed Amîtsoq gneisses from the Godthaab district, which occupy the lower third of AO. It is highly improbable that these two samples actually represent Amîtsoq gneisses : they would be very unusual in having suffered much less severe U-depletion than any analysed Amîtsoq gneisses from the Godthaab district. Consequently it is very unlikely that these two samples should be interpreted differently from other K-s-Q samples.

We conclude that the K-s-Q gneisses represent an addition of substantially juvenile mantle-derived material to the Archaean craton of West Greenland during late Archaean times. Some of the parent magmas have undergone interaction with older crust, as indicated by the Pb isotope evidence for contamination with Amîtsoq-derived Pb. However, the positive $\epsilon$ Nd(I) value for the K-s-Q gneisses firmly rules out any significant material contribution from the Amîtsoq gneisses to the K-s-Q gneisses.

Reference.

(1) Taylor,P.N., Moorbath,S., Goodwin,R. & Petrykowski,A.C. (1980) Geochim. Cosmochim. Acta 44, 1437-1453.

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