SHORT COMMUNICATIONS

RADIOMETRIC EVIDENCE FOR A PRECAMBRIAN METAMORPHIC EVENT IN N.W. SPAIN

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Petrological and structural arguments for the presence of a remetamorphosed Precambrian basement in the Hesperian Massif (N.W. Spain and N. Portugal) have been presented by several authors in the last few years: P a r g a P o n d a l (1956), P o r t u g a l F e r r e i r a (1965), d e n T e x (1966), V o g e l (1967), W a r n a a r s (1967) and v a n Z u u r e n (1969). These arguments agree with the radiometric dates on younger rocks (unaffected by Precambrian metamorphism) from this area (P r i e m et al., 1970), but no radiometric dates indicating Precambrian ages have so far been obtained. The principal reason for the lack of K/Ar dates is, that during the Hercynian orogeny (340-280 m.y.; P r i e m et al., 1970) most of the Precambrian metamorphic assemblages in the Hesperian Massif underwent partial or complete recrystallization. Material suitable for Rb/Sr dating with the means at present available is absent among the Precambrian rocks;

For the eclogites and pyrigarnites found in the area around Cabo Ortegal, a Precambrian age was inferred on petrographic grounds (V o g e l, 1967). They are in part unaffected by Hercynian retrogradation. The common constituents of the eclogites, omphacite, garnet, zoisite and kyanite, are too poor in potassium to permit reliable K/Ar age determinations. However, in one locality, an eclogite was found having karinthine with a sufficiently high potassium content (0,21 wt. %) as a major constituent. Thus, only one, unsupported, K/Ar measurement on a karinthine separated from this rock (sample V 1023IV) can be presented here.

(1) The potassium has been determined by atomic absorbtion techniques. The uncertainty of the method is ± 2% based on analyses of USGS standards.

(2) The argon has been determined by isotope dilution technique using a mass spectrometer. The uncertainty in the analysis is ± 3%.

(3) The constants used in the age calculation are:

$\lambda_e = 0.585 \times 10^{-10}$ yr.$^{-1}$;

$\lambda_b = 4.72 \times 10^{-10}$ yr.$^{-1}$;

$K^{40}/K = 0.0119$ atomic %. The total uncertainty in the calculated age is 3.6%.

K/Ar ages from metamorphic terrains should be evaluated with extra care. The problems of either

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Sample	Material dated	%(wt.) K(1)	cc STP (2) $A\dot{r}/gram \times 10^{-6}$	$A\dot{r}/Ar_t$	Age (m.y.)(3)
V 1023IV	Karinthine	0.21	9.60	0.85	897.5 ± 32

extraneous, or lost argon should be critically considered. Convincing cases of excess argon in amphiboles have not been reported so far, however. In view of the fact that the Cabo Ortegal eclogites were formed under moderate confining pressure (estimated 14-18 kb.), while subjected to stress, it is not thought likely that the karinthine has any excess argon.

On the other hand, Hart (1964) and Hanson and Gast (1966) have shown that in contact metamorphic zones hornblende may lose, depending on the degree of heating, all or part of its radiogenic argon; which can result in erroneous age determinations. Gerling et al. (1965) have shown that the activation energy for the liberation of argon from aphiboles varies as a function of their iron content. The activation energy increases with decreasing F ($F = FeO + Fe_2O_3/FeO + Fe_2O_3 + MgO + MnO$), and is equal to 200 kcal/mole for a pargasite with F = 26.8%. Their calculations also indicate that for such an activation energy, a hornblende subjected to a temperature of 670°C during 10^8 years, would show no significant loss of argon. Since the analyzed karinthine has a significantly lower F value, (F = 22%, Vogel, 1967), and the Hercynian metamorphism took place under amphibolite facies conditions (estimated temperature lower than 650°C; den Tex, 1965); it will be assumed here that no significant loss or argon occurred as a result of reheating during the Hercynian orogeny. This assumption may be in part incorrect since activation energies calculated from natural systems are, as a rule, much lower than those measured in the laboratory (Priem, private communication).

The possibility of compositional modification of the karinthine as a result of retrograde metamorphism is also judged unlikely on the basis of the complete absence of evidence of deformational features or retrograde alterations in thin section.

In view of the above, it is assumed that the 900 ± 30 m.y. age determined for the karinthine represents a good approximation of the oldest metamorphic event in the Cabo Ortegal area. It corresponds well with K/Ar (whole rock and single mineral) ages varying from 1050-870 m.y. as determined by Leutwein (1968) for the Pentévrien in the nearby Armorican Massif. Ages in this range also characterise the Grenville province on the other side of the Atlantic ocean.

This single analysis is presented here in the knowledge that it stands supported by field evidence only. It is hoped that it will serve as a stimulus in the search for other "Precambrian" material from the Galician area that has suitable properties for radiometric dating.

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