A single subduction event at ca. 392 Ma for the ultramafic-mafic HP/HT-rocks of the Cabo Ortegal Complex

Un único episodio de subción a ca. 392 Ma para las rocas máficas- ultramáficas de alta P y alta T del Complejo de Cabo Ortegal

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ABSTRACT

SHRIMP-dating of zircons from ultramafic, mafic and metasedimentary high-pressure (HP) rocks of Cabo Ortegal gave the following results: The MORB-type protoliths of the eclogites are Cambrian (507±17 Ma). Their transformation into eclogites occurred during a Devonian subduction that was accompanied by partial melting of the mantle wedge, giving rise to the formation of pyroxenites. The Ion-microprobe-data suggest a single HP-loop around 392 Ma that involved all analyzed rocks.

RESUMEN

La datación de zircones, mediante SHRIMP de rocas ultramáficas, máficas y rocas metasedimentarias de alta presión (HP) del complejo de Cabo Ortegal, muestra los siguientes resultados: Los protolitos de tipo MORB de las eclogitas son Cámbricos (507±17 Ma). Su transformación a eclogitas tuvo lugar durante una subducción Devónica que estuvo acompañada de una fusión parcial en la cuña mantélica produciendo la formación de piroxenitas. Los datos producidos mediante la microsonda-iónica sugieren un único episodio metamórfico de alta presión alrededor de los 392 Ma para todas las rocas analizadas.

Key words: *Cabo Ortegal, HP rocks, zircons, SHRIMP-dating, subduction.*

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Ion-microprobe (SHRIMP-II, Sensitive High Resolution Ion Microprobe) data are reported for zircons extracted from ultramafic, mafic and metasedimentary high-pressure rocks of the Cabo Ortegal allochtonous complex (Galicia, NW Spain Fig. 1). Cathodoluminescence studies on the zircon mounts used for SHRIMP-dating allowed to differentiate between both magmatic and metamorphic zircon domains that were then dated individually. The zircon fractions used for this study are taken from the ones used for conventional U-Pb-dating by Peucat *et al.*, (1990).

Magmatic zircon domains analyzed for an eclogite of MORB-type composition (sample 1) yielded ages at 507 ± 17 Ma (95 % c.l., as all other errors given below, unless stated otherwise). The metamorphic zircon domains yielded ages at 397 ± 28 Ma for the HP-metamorphism. Similar areas from a kyanite-rich eclogite (sample 2) result in 473 ± 9 and 382 ± 13 Ma, respectivily.The SHRIMP results are not in agreement with the previous conventional data, that were interpreted to give two HP-events at ca. 480 Ma and ca. 420 Ma (Peucat *et al.*, 1990).

SHRIMP-data on zircons from a basic granulite (garnet-clinopyroxene high-pressure granulite, Bacariza Fm., sample 3) indicate a protolith age for the possibly arc-type source rock at 481 ± 5 Ma. This age is consistent with the $^{207}Pb/^{206}Pb$ age of 482 ± 7 Ma obtained by conventional multigrain dating (Peucat *et al.*, 1990). The latter data were interpreted to be related to the emplacement of the probable calc-alkaline protolith and its inmediate metamorphism into granulites. In contrast, the SHRIMP- and CL (cathodoluminescence) data do not support an Ordovician granulite facies event but rather infer also a Devonian high-pressure granulite-forming event.

Zircons from a garnet-pyroxenite vein and a spinel lherzolite (Uzal ultramafic massif,samples 4 and 5, respectively) yielded ages at 388 ± 8 Ma and 395 ± 8 Ma, respectively. The SHRIMP-data were obtained on both magmatic and metamorphic zircon domains and suggest crystallisation during partial melting of the mantle under HP-conditions. The age of the garnet pyroxenite vein is in agreement with the conventional mean $^{207}Pb/^{206}Pb$ ages (392 ± 4 Ma, Peucat *et al.*, 1990). It is also in line with U-Pb ages on rutile (382 Ma) from a garnet pyroxenite as well as with zircon-, monazite- and Rb-Sr isochron data from a granite pegmatite within peridotites of the Herberia and Uzal massifs, (388 Ma; Santos *et al.*, in press).

Deposition of the sedimentary precursor of the eclogite-facies Chimparra Gneisses (sample 6) must be Cambrian or post-Cambrian as the age of the youngest detrital zircon grain is 508 ± 21 Ma (1σ).

Derivation of the detrital zircons from Gondwanian sources is supported by PanAfrican ages around 540 Ma and concordant ages around 1.21 to 2.14 Ga. One spot in a metamorphic rim within a ca. 2 Ga old detrital zircon grain yielded an age of 392 ± 27 Ma (1σ).A similar age of 391 ± 8 Ma was found for zircon within coarse-grained, granoblastic Chíparr gneiss (sample 7) at the contact of the Uzal peri-

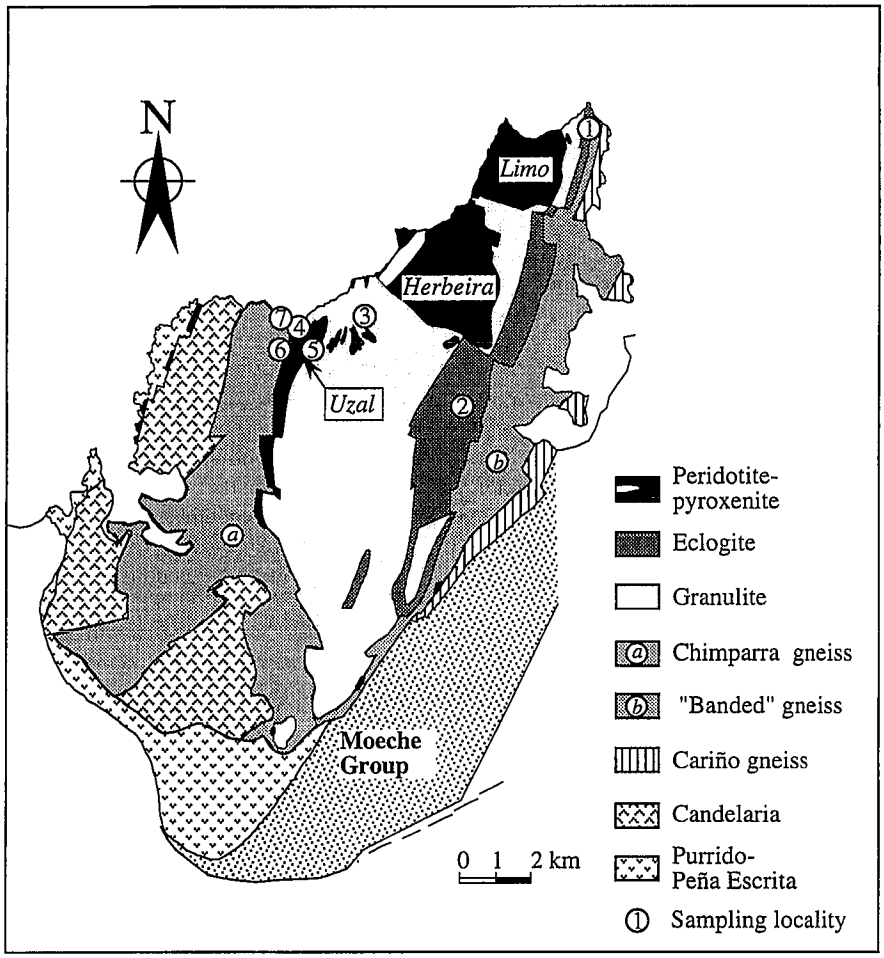

Fig. 1.- Geological sketch-map of the Cabo Ortegal Complex showing major lithological units and sampling localites (modified after Vogel, 1967).

Fig. 1.- Mapa geológico simplificado del Complejo de Cabo Ortegal mostrando las principales litologías y situación de las muestras estudiadas (modificado a partir de Vogel, 1967).

dotite massif. This suggest a metamorphic event at the same time as derived for eclogite formation and partial melting of the mantle.

The new data obtained so far suggest that the protoliths of most of the eclogites and mafic granulites have formed over an extended time period in a Cambrian oceanic scenario and a possible Ordovician arc environment, respectively.

We have found no evidence for a HP metamorphic overprint at 480 Ma. Similarly, the previously proposed second HP event in the Silurian can not be supported by the Ion-microprobe results. The conventional, multi-grain U-Pb-data can, when deviating from the SHRIMP-, easily be explained by the presence of more than two zircon domains of different ages, e. g. variably old, inherited zircons or zircon domains, protolith zircon domains, metamorphic zircon domains and zircon domains that suffered post-metamorphic lead loss. All of these domain-types may either yield concordant or discordant U-Pb ages.

In conclusion, the SHRIMP-data suggest a single subduction induced P-T-t loop for all analyzed rocks with a climax around 392 Ma. Very probably, fluids released from the subducted slab into the overlying mantle wedge triggered partial melting of the mantle source to produce the garnet pyroxenites and interstitial mantle melts.

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