U-Pb SHRIMP ZIRCON, $^{40}Ar/^{39}Ar$ GEOCHRONOLOGY AND Nd ISOTOPES FROM GNEISSIC AND GRANITOID ROCKS OF THE ILLESCAS MASSIF, PERU: A SOUTHERN EXTENSION OF A FRAGMENTED LATE PALEOZOIC OROGEN?

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THE PROBLEM

Late Paleozoic to Triassic tectonics of the proto-Andean margin is related to the agglutination of Pangea and the evolution of the Pacific subduction (Cawood and Buchan, 2007). Recent geochronological results from the northern Andes have shown the existence of remnants of Permian to Triassic magmatic and metamorphic terranes, controversially interpreted as collisional or accretionary orogens (Fig. 1A, Vinasco et al., 2006, Weber et al., 2007), or correlated with the Alleghanian orogenic belts of North America and some Mexican allocthonous terranes (Pindell and Barrett, 1989). In this contribution, zircon U/Pb SHRIMP geochronology, $^{40}Ar/^{39}Ar$ analyses in biotites and whole rock Nd isotopic work on gneissic and granitic rocks of the Illescas Massif from the northern coast of Peru (Fig. 1B) are presented. The massif 's crustal evolution and correlation of this massif within the framework of this paleotectonic scenario are discussed.

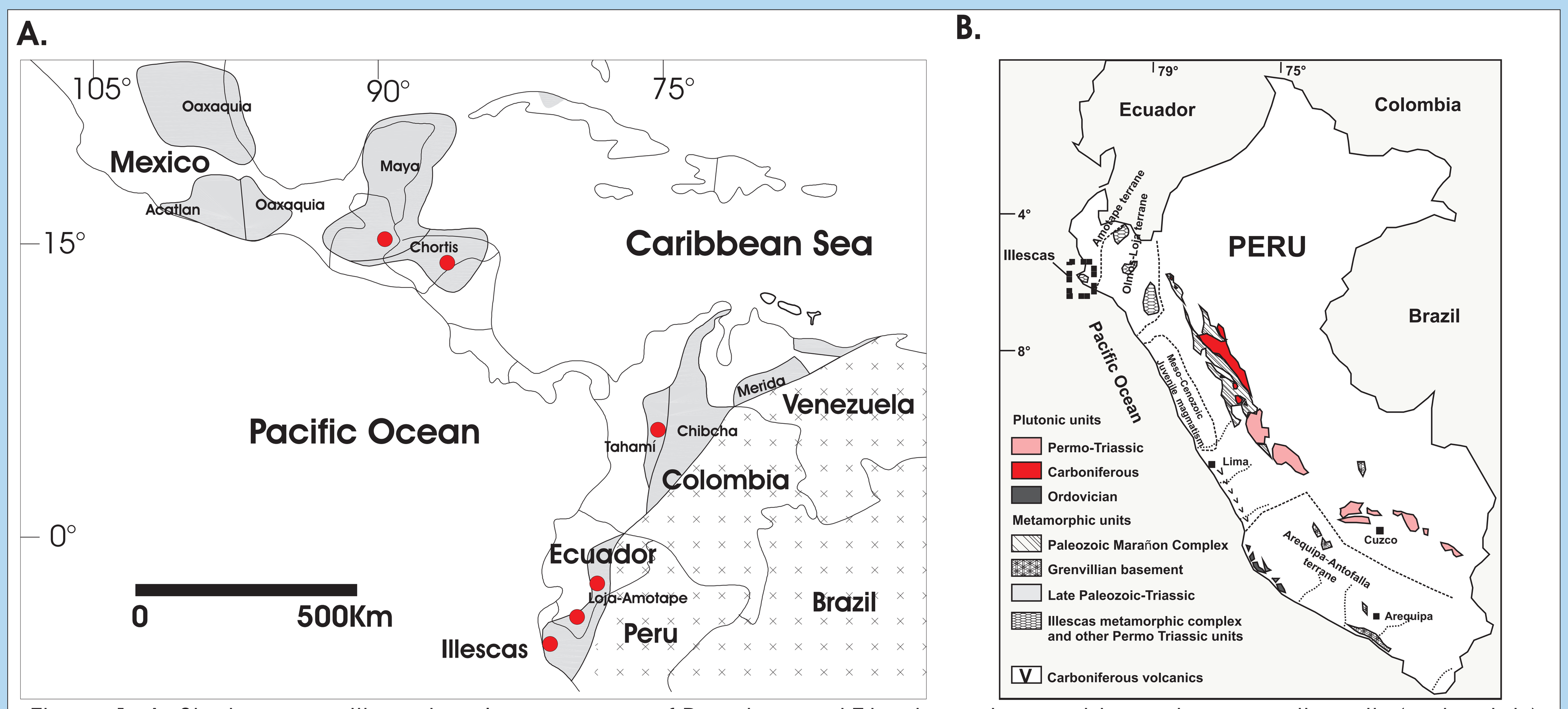

Figure 1. A. Study area, with regional ocurrences of Permian and Triassic metamorphic and magmatic units (red points). Terranes with Paleozoica and Precambrian basement of Colombia and Mexico. B. Research area and metamorphic complexes of Peru. Modified after Stewart et al. (1999), Cardona et al. (2007).

GEOLOGICAL SETTING

The coastal configuration of Illescas (Fig. 2A) is a by-product of the oblique convergence of the Pacific plate, that have caused the detachment and rotation of several blocks in NW Peru (Jaillard et al., 2000). Geologically is made of gneissic rocks that grade into syntectonic two-mica-garnet granitoids (Fig. 2B) and associated andalusite and muscovite schists (Caldas, 1979). Discordant intrusive tonalitic stocks and late E-W alkaline basaltic dikes cut the entire massif.

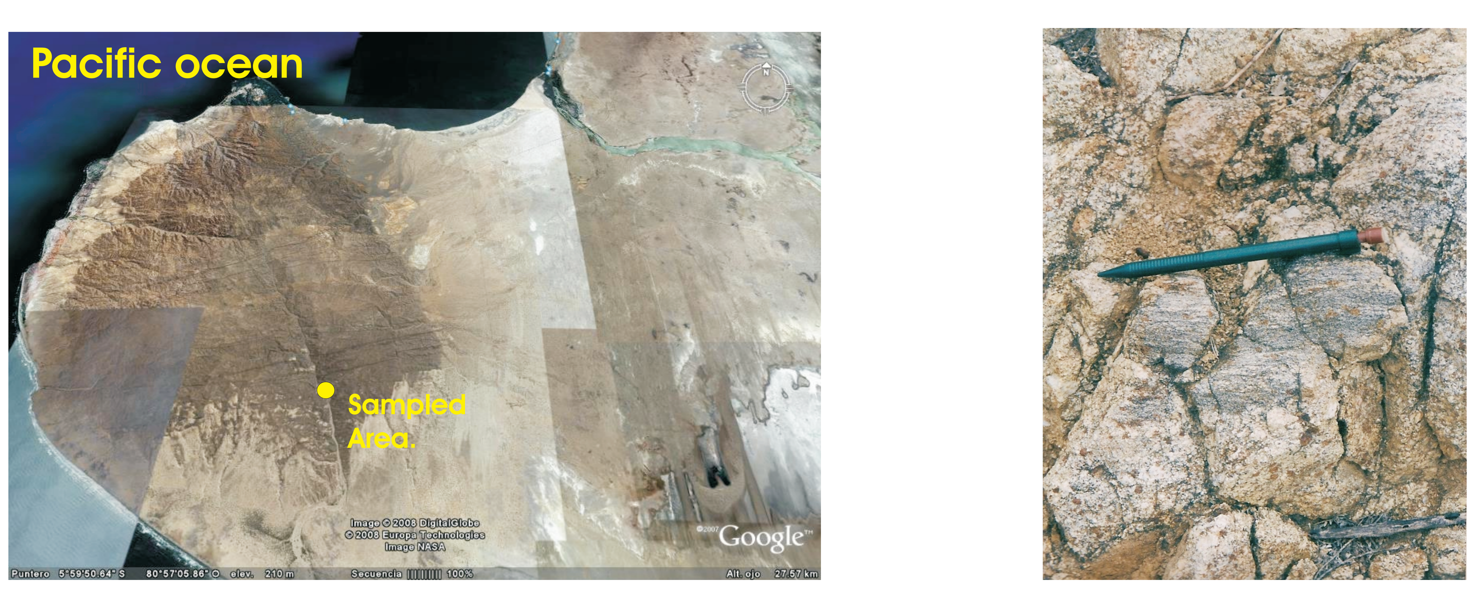

Figure 2. A. Illescas Massif, B. Syn-tectonic granitoid and paragneiss.

U/Pb SHRIMP and Ar/Ar results

Six metamorphic rims from a garnet-biotite paragneiss yielded a $^{206}U/^{238}Pb$ mean age of 257 ± 8 Ma (Fig. 3). Seven oscillatory-zoned cores yielded $^{207}Pb/^{206}Pb$ ages between 390 Ma and 1690 Ma, that are related to inherited detrital zircons. A maximum Devonian age for protolith formation is inferred. Biotite $^{40}Ar/^{39}Ar$ results from a paragneiss (I3) yielded plateau ages of 196.3 ± 0.5, whereas a massive granitoid (I9A) showed well developed 184.3 ± 0.6 Ma age (Figs. 4A and 4B). These ages are related to regional cooling of the host rocks and the subsequent Jurassic intrusion.

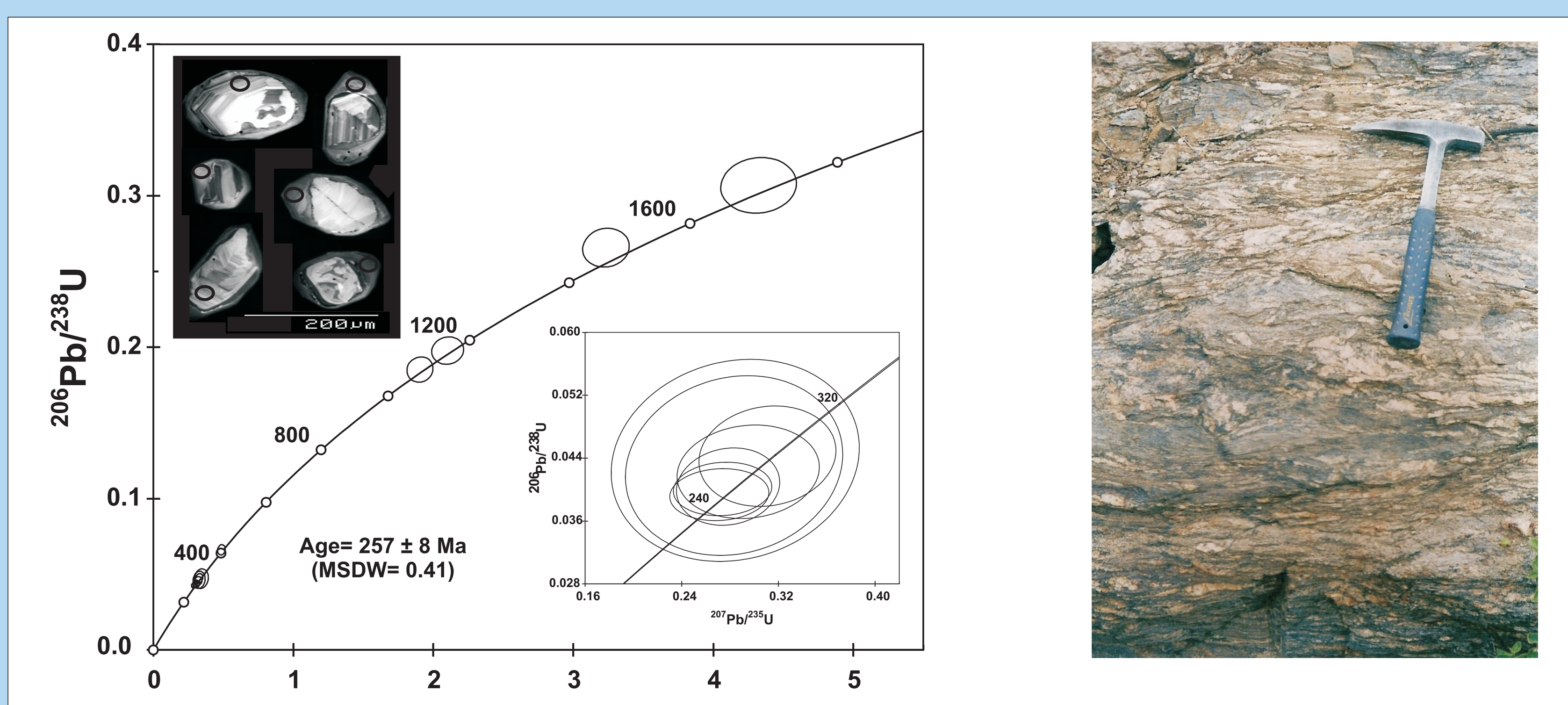

Figure 3.U/Pb SHRIMP zircon geochronology of sample I6 of the Illescas Gneiss.

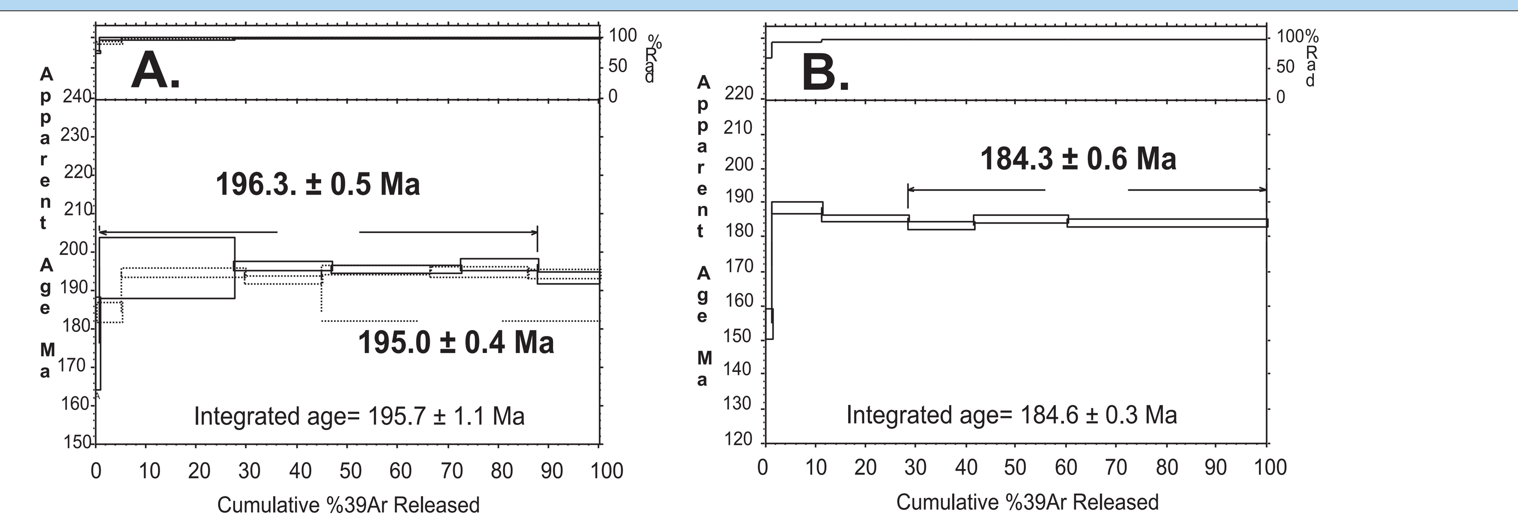

Figure 4. Ar-Ar ages of sample I3 of the Illescas Gneiss (A) and of sample I9A of the intrusive granitoid (B).

Nd ISOTOPES

Illescas Gneiss samples (I3 and I6) yielded Sm-Nd T_{DM} model ages of 1.5 and 1.7 Ga and negative initial ε_{Nd}, whereas one sample of the intrusive granitoid (I9A) shows a slightly less negative pattern (Fig.5). Similar Nd isotope patterns can be seen in the Olmos massif metasediments, within the Andean Cordillera, where three metasediments have yielded ε_{Nd} negative values. This kind of assimilation and reworking is characteristic of all the northern Andes domains (Noble et al., 1997, Cardona et al., 2007), and shows that the rocks were formed within older continental crust.

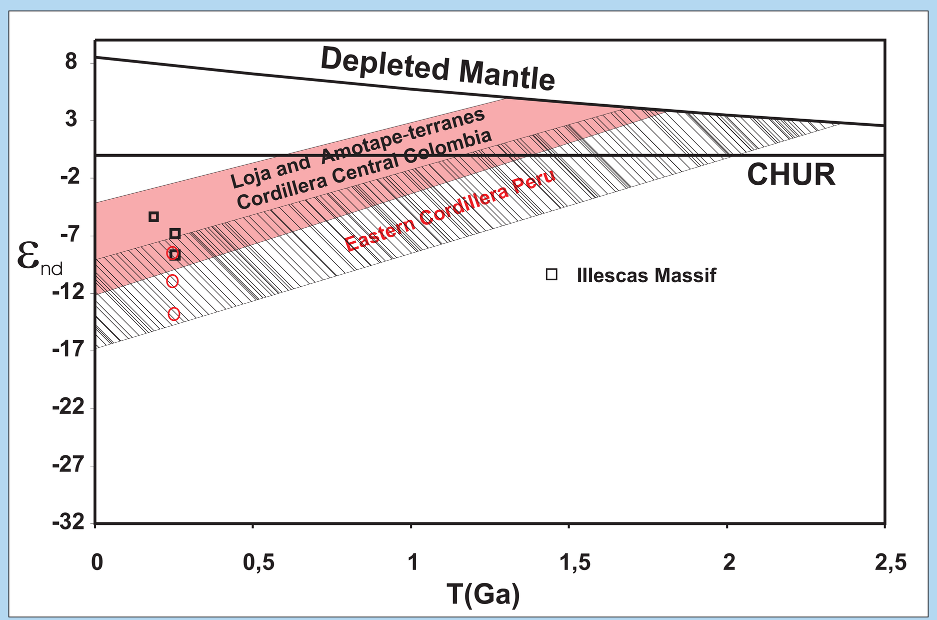

Figure 5. Nd Isotopes from the Illescas Massif compare with the envelopes of the Eastern Cordillera of Perú, the Ecuadorian and Colombian Andes (data from Vinasco et al. 2006, Cardona et al., 2007)

TECTONIC IMPLICATIONS

A Permian metamorphism is contemporaneous with syntectonic S-type magmatism. A regional low-pressure baric type recrystallization suggests that both process are connected as seen in accretionary orogens (Collins et al., 2002). The protoliths of this gneiss were formed after the Devonian by the reworking of Middle Paleozoic and Proterozoic sources within an older continental domain. Similar characteristics are seen in northern Peru, Ecuador, Colombia, and the allocthonous terranes of Central America (Fig. 6, Noble et al., 1997, Vinasco et al., 2006, Weber et al., 2007). This event is younger than the Appalachian orogenic belts that record Laurentia-Gondwana interactions during the formation of Pangea (Hatcher, 2002). Therefore alternative tectonic scenarios for this broader continental orogen include: (1) Terrane accretion, or (2) Pacific subduction with thickened oceanic plate or stronger plate coupling (Cawood and Buchan, 2007). The Jurassic magmatism is related to the subduction of the Pacific plate along the margins of the Americas.

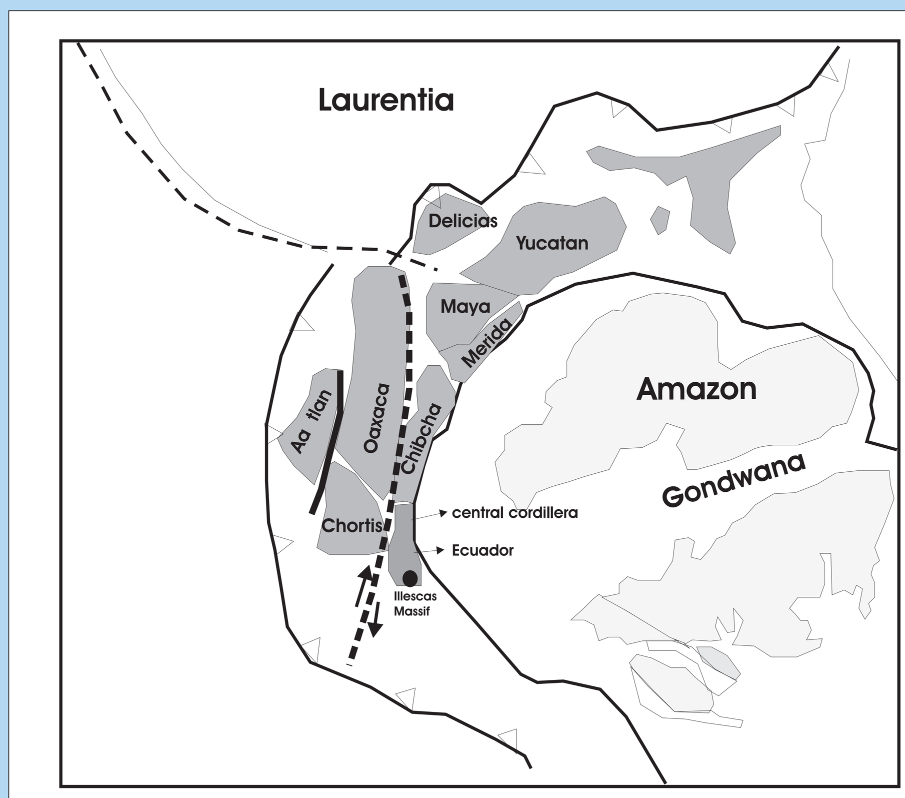

Figure 6. Late Permian to Late Triassic tectonic reconstruction of west central Pangea (modified from Weber et al., 2007).

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