High-pressure rocks from the Colombian Caribbean – Record of a changing convergent margin

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P-T-t evolution of Cretaceous high-pressure rocks found as fragments in a Tertiary conglomerate from the Guajira Peninsula of Colombia, record the complex multistage history of the southern-margin subduction and collision zone of the Caribbean plate and Northern South America. The metamorphic rocks include metamafites (kyanite eclogites) and metasedimentary rocks (garnet-kyanite schists, glaucophane-bearing garnet gneisses and garnet-bearing chloritoid gneisses), that represent both oceanic and continental protoliths trapped in an accretionary wedge. Early Eocene granitoids as well as gabbros and serpentinites are also common in this conglomerate.

Mineral chemistry and textural evidence show two phases of prograde syn-tectonic metamorphic growth, and peak metamorphic conditions where calculated at 770°C and minimum pressures of 17 kbars. Some of these high pressure rocks have reequilibrated completely at amphibolite-facies conditions.

The earlier prograde phases are related to the subduction-colision event in the oceanic-continental margin, and the begining of exhumation, whereas the later amphibolite facies overprint suggests that the exhumation rates possibly diminished, probably as a consequence of shifting towards a more oblique convergent margin.

Geochemical variability in deep-sea sediments of the Eastern Equatorial Pacific: Foundation for orbital-based chronology since the Late Miocene

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Goals

The goal of this study is to provide an orbital-based chronology for sediments from the Peru Basin, eastern equatorial Pacific (EEP), that allows for the reconstruction of the deep-sea response to major oceanographic changes since the Upper Miocene. We present carbonate, opal, and XRF element data measured on samples and obtained non-destructively on 26 sediment sites. Chronology is based on magnetic polarity changes, biostratigraphy, stable oxygen isotopes, and tuning the carbonate and opal proxy records to orbital insolation. Accordingly, we obtained age models with 21-kyr control points.

Evolution since the Upper Miocene

The youngest core covers the last 1.3 Ma and the oldest core reaches back until the Upper Miocene (7.74 Ma), with sedimentation rates of 2 to 0.1 cm/kyr, respectively. A stacked carbonate record of all 26 sites minimizes local influences and provides the regional information that is necessary for large-scale climate considerations.

Accordingly, a pronounced carbonate maximum at 6.8 to 6.4 Ma is most likely associated with ‘the biogenic bloom’. Until 4.6 Ma, there is a long-term decrease with internal 400-kyr eccentricity cycles, probably amplified by pulsations of the Antarctic ice sheet and linked to the final narrowing of the Isthmus of Panama. Very low amplitudes in the 400-kyr component between 4.5 and 3.4 Ma indicate the isolation of the EEP from the Atlantic (Caribbean) due to the final closure of the Isthmus, and the time required to reorganize circulation. At 2.7 Ma, carbonate contents began to increase with a peak at 2.4 Ma. This time probably marked the first substantial glaciation of the northern hemisphere as a preservation and/or productivity spike in the EEP, followed by a gradual decrease until the Pliocene/Pleistocene boundary, a period that yields a major environmental change from oxic to suboxic conditions, indicative for a distinctive decrease in deepwater oxygen content. This change is accompanied by a 0.7-myr hiatus. During the Pleistocene, the 100-kyr amplitude of the stack started to increase at 1.3 Ma, suggesting that the response to the 100-kyr eccentricity cycle might have evolved in low latitudes and migrated to higher latitudes at 0.9-0.8 Ma. In conclusion, geochemical variability is strictly orbital controlled and traces all major oceanographic changes in the EEP.