Goran Andjic – Late Mesozoic–Cenozoic sedimentary and tectonic evolution of Middle American plateau and forearc terranes (Nicaragua, Costa Rica) – Institut des sciences de la Terre – FGSE

Abstract

Situated along the western edge of the Caribbean Plate, the southern Central American active margin has a well-documented 145 million year record of oceanic assemblages accretion. The oceanic terranes that compose most of the southern Central American land bridge were emplaced during two major Cretaceous phases. First, a Franciscan-type mélange (Mesquito Terrane) accreted to the continental Chortis Block of North America during the earliest Cretaceous. Then, the Caribbean Large Igneous Province (CLIP) became engulfed between the North and South American plates during the Late Cretaceous. In each case, volcanic arcs developed on the top of the accreted basements in response to subduction initiation along their western margins. The volcanic arcs contributed significantly to the development of forearc, intra-arc and backarc basins. Indeed, the ages of the basements and the bio-lithostratigraphy of the overlapping sediments provide constraints on the timing of terrane accretion and subsequent volcanic arc initiation. The study of forearc basins represents a powerful tool in order to understand the tectonic evolution of active margins, which includes processes such as: subduction erosion/accretion, oblique subduction, arc-continent collision, and margin extension. The Central American isthmus emerged through time by a complex interaction between tectonic events and growth of successive volcanic arcs. Part of this changing paleogeography was recorded in the forearc basins. Fortunately, the Pliocene–Quaternary collision of bathymetric highs uplifted parts of the forearc basins that are now cropping out.

Based on fieldwork and samples recovered in the forearc of northwestern Costa Rica, we present new biostratigraphic, sedimentologic and geochemical data which allow to constrain: 1) the collision timing of the CLIP with the Mesquito Terrane, which resulted in the accretion of the Manzanillo Terrane; 2) the timing of volcanic arc (Berrugate Arc) initiation on the Manzanillo Terrane. The Coniacian–upper Campanian Berrugate Arc predates the development of the South Central American Arc in Costa Rica and Panama. The latter started during the late Campanian following the subduction initiation along the western edge of the CLIP. The Berrugate Arc was shut down by the accretion of the Nicoya Complex during the middle–late Campanian.

During the middle-late Eocene–Oligocene, a major tectonic event affected south Central America and several other circum-Caribbean provinces. (1) In the Tempisque and Sandino forearc basins (NW Costa Rica-W Nicaragua), this uplift event led to the deposition of shallowing-upward sequences in some places, and major unconformities in some other places. Deep- to shallow-shelf carbonates and volcaniclastics were deposited on uplifted deep-basin lithologies. (2) A lower Oligocene hiatus exists in several sections of the basins, which suggests a period of erosion/non-deposition. Emersion could have been achieved by still active uplift and drops of the eustatic sea-level, which were of high amplitude at Eocene–Oligocene and lower–upper Oligocene boundaries. (3) The upper Oligocene was a renewed period of shelf sedimentation. These facies successions are interpreted as the result of forearc uplift in response to bathymetric highs collision (1–2); post-collisional subsidence followed during the late Oligocene (3). Direct evidence for the accretion of Galápagos-derived seamounts is found along forearc areas of western Panama and western-southwestern Costa Rica.

The effects of these collisions were recorded as far as the southern Sandino Forearc Basin (southwest Nicaragua). On the other hand, the central and northern Sandino Basin were not significantly affected by the collision-related uplift, as deep-water sedimentation continued during most of the Oligocene. Instead, only vertical, arc-parallel, transpressional structures modified the basin depocenter during the early Oligocene. In the uplifted southern Sandino Basin, these structures facilitated the growth of one of the most impressive Oligocene coral reefs of south Central America. During the latest Oligocene, a second transpressive phase uplifted parts of the basin that were located landward. This uplift phase possibly facilitated the seaward progradation of shelf volcaniclastics during the early Miocene. We interpret the Oligocene transpressional structures as the response of the forearc to oblique subduction, which operated along the Middle America trench prior to the fission of the Farallon Plate during the latest Oligocene.