Onshore study of syn-orogenic olistostromic deposits in the Gibraltar Arc: a tool to reveal mountain front uplift

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- Western Mediterranean Alpine orogens.
  - Arc-shape geometry.
  - Fold-and-thrust belts developed in the external zones.
  - Back-arc basins over the internal zones.
  - Formation of accretionary prism (Flysch Trough Domain) along the internal-external zone boundary.

Gibraltar Arc

- **Internal zones**: Represented by the Alboran Domain. A post-metamorphic nappe-stack thinned during Miocene times.
- **External zones**: Fold and thrust belt composed by South Iberian-Maghrebian cover and the Flysch Trough Domain.

Alozaina complex

• “Flysch-like” complex emplaced along the boundary between internal and external zones, essentially over the Alboran Domain.
• Undefined mode of emplacement.
• Unknown age (resedimented fauna).
• Key element to understand the evolution of the mountain front and to correlate processes between internal and external Domains.
- Alozaina complex
  - Seals most of the structures associated with the Miocene rifting.
  - Characterized by olistoliths of various origins embedded in a turbiditic matrix.

• Olistoliths can be classify in three groups:
  – Flysch-type rocks.
  – Jurassic to Cretaceous carbonate rocks.
  – Palaeozoic rocks, which derive from the nearby Alboran Domain.
Flysch-type olistoliths maintain the structure derived from previous deformation.

The analysis of two kilometre-scale olistoliths provide key data about age relationships between olistoliths and matrix.

**Olistostromic deposits in the Gibraltar Arc**
Case of a Flysch-Type kilometre-scale olistolith.

- Formed by various slices which belong to different lithostratigraphic units.
- A near horizontal surface cuts the base of the structured olistolith.
Flysch-type olistolith main features

- Imbricate thrust sequence: S-vergent and arcuate geometry (NNW- to NE-directed).
- Age range of the sequences: Eocene-Oligocene to Aquitanian.

Modified from Spanish geological maps (MAGNA)
Flysch-type olistolith main features

- Alternating of quartzitic and micaceous rocks (hectometric bedding, Aquitanian in age).
- Structure of the olistolith: closed synform.

Modified from Spanish geological maps (MAGNA)
• The structure of the olistoliths shows strong similarities with that of the Flysch Trough complex units.
• Lithological correlation between the olistoliths from Alozaina complex and the Flysch Trough units can be established.

• It is also structured as an imbricate thrust and fold belt.

• Thrusts involve units mainly from Paleogene to Aquitanian sandstone formations.

Modified from M. Luján et al. (2006) *Tectonics.*
- Flysch-type olistoliths from Alozaina complex derive from an already structured and uplifted Flysch Trough Domain.
- Olistoliths of various provenance (internal and external zones).
  - The Alozaina complex results from the gravitational dismantling of the already structured units situated along the internal-external zone boundary.
  - The deposition of the Alozaina complex had to occurred from Langhian to Serravalian times.

Regional implications

- Triggering of the gravitational dismantling was more likely helped by:
  - Fast uplift of the mountain front.
  - Extensional tectonics in the Alboran Domain.

- In the western Alboran Domain, extension associated with Miocene rifting can not extend beyond the deposition of the Alozaina complex, at least onshore.

- The Alozaina olistostromic complex represents a late stage of the Alboran Domain rifting.
Regional implications

- Offshore, the western Alboran Domain shows a thick sedimentary sequence from Lower to Middle Miocene.
- The Alozaina complex can most likely be correlated with part of this sedimentary sequence.
  - Erosion of the already uplifted mountain front was coetaneous with large subsidence at the Alboran Domain.
  - Very important vertical movements took place in the Gibraltar Arc orogenic system, at least during Middle Miocene times.