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Tectono-stratigraphic analysis of the Malvinas Basin, offshore the southernmost Argentinean continental margin

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A detailed tectono-stratigraphic analysis of the Malvinas Basin development, located offshore the Argentinean margin, was carried out. This was achieved through the interpretation of around 65,000 km of 2D seismic reflection profiles, spanning a dense grid on the shelf and the upper-slope of the basin.

Five main seismo-stratigraphic units and their sub-units, informally named U1 to U5 a/b, bound by major unconformities were identified and correlated with the Mesozoic to Cenozoic main tectonic phases of the basin. U1 (Pre-168 Ma) represents the seismic basement and deepens gradually southwards. U2 (168-150.5 Ma, syn rift phase) fills regional depressions, onlapping the basement, and it thickens and deepens southwards. U1 and U2 are affected by several syn-rift normal faults, which have a main NE-SW strike direction in the south of the basin and a NW-SE strike direction in the centre of the basin. This suggests that the Malvinas Basin may have been developed initially as a rift basin with two different extensional directions. (1) a NW-SE directed extension probably linked with the opening of the Weddell Sea (Early Mid-Jurassic) and (2) a NE-SW directed extension most likely linked with the opening of the South Atlantic during Mid-Jurassic to Early Cretaceous. U3 (150.5-68 Ma, sag phase) is mainly an aggradational wedge-shaped unit. Some syn-rift faults continue into the Cretaceous. Sedimentation in this unit is mainly derived from the north and during Mid-Cretaceous also from the northeast, as documented by the presence of a southwestward prograding sedimentary fan located in the northeast of the basin. U4 (68-42.5 Ma, transtensional foredeep phase) overlies unconformly U3 and thickens to the south. Sediment input decreases dramatically during that time and only a thin sedimentary succession was deposited over the entire basin.

Although a regional compressional regime is established from late Cretaceous to Cenozoic due to the Andean orogenesis, an extensional regime established in the Malvinas Basin during the Paleocene to early Eocene. This period was accompanied by the development of a deep sedimentary trough in the south. Extension was possibly related to the opening of the Drake Passage or to lithospheric flexure and bending. Structures mainly consist of reactivated normal faults, strike-slip faults and some minor reverse faults. The units U5a and U5b (42.5-5.5 and 5.5-0 Ma, transpressional foredeep phase) represent a stratigraphic switch from aggradation to progradation. While on the west of the basin downlapping clinoforms prograding eastwards are present, a northward onlapping wedge is identified in the deeper southern part of the basin. During this time, the sediment supply was considerably higher. The entire basin was filled and the depocenter migrated southeastwards. The tectonic regime changed to compression and later during the Oligocene to transpression, developing a major sinistral transpressional fault in the south of the basin. In summary, the basin developed initially as a Mesozoic rift basin which switches to a foreland basin with a sinistral wrench component and increased sediment input in the south during the Cenozoic.