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New Insights into Passive Margin Development from a Global Deep Seismic Reflection Dataset

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The kinematic and dynamic evolution of the world's passive margins is still poorly understood. Yet the need to replace reserves, a high oil price and advances in drilling technology have pushed the international oil and gas industry to explore in the deep and ultra-deep waters of the continental margins. To support this exploration and help understand these margins, ION-GXT has acquired, processed and interpreted BasinSPAN surveys across many of the world's passive margins.

Observations from these data lead us to consider the modes of subsidence and uplift at both volcanic and non-volcanic margins. At non-volcanic margins, it appears that frequently much of the subsidence post-dates major rifting and is not thermal in origin. Rather the subsidence is associated with extensional displacement on a major fault or shear zone running at least as deep as the continental Moho. We believe that the subsidence is structural and is probably associated with the pinching out (boudinage) of the Lower Crust so that the Upper crust effectively collapses onto the mantle. Eventually this will lead to the exhumation of the sub-continental mantle at the sea bed.

Volcanic margins present more complex challenges both in terms of imaging and interpretation. The addition of volcanic and plutonic material into the system and dynamic effects all impact subsidence and uplift. However, we will show some fundamental observations regarding the kinematic development of volcanic margins and especially SDRs which demonstate that the process of collapse and the development of shear zones within and below the crust are also in existence at this type of margin. A model is presented of 'magma welds' whereby packages of SDRs collapse onto an emerging sub-crustal shear zone and it is this collapse which creates the commonly observed SDR geometry.

Examples will be shown from East India, Newfoundland, Brazil, Argentina and the Gulf of Mexico.