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Revisiting the Wilson Cycle in the North Atlantic: The role of inheritance

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According to the Wilson Cycle, oceans open and close approximately parallel to ancient suture zones, suggesting a major control of inheritance in the extension and convergent process. While this paradigm is well illustrated in the northern North Atlantic where the rift follows largely the Iapetus suture between Norway and Greenland, this is not the case for the southern North Atlantic, where neither the westward, nor the northward propagating branch of the Central Atlantic rift, affected the Variscan sutures of Western Europe.
These observations suggest that inheritance is not necessarily reactivated during subsequent rifting events and begs the question about what may truly control the localization and details of rift systems.
One possible cause for the differing behavior of the North Atlantic rift with respect to the Caledonian and Variscan orogens may be their contrasting paleo-geographic settings. Indeed, the Scandinavian Caledonides resulted from the closure of one wide ocean between two cratonic shields, whereas the Variscides were built from the accretion of several terranes/micro-continents following the closure of a series of narrow oceans. The variability in the initial architecture of the intervening rift systems and in their subduction processes may have significantly controlled the subsequent orogenies.
The aim of this presentation is twofold: first we investigate how the first-order structural and lithological characteristics of narrow/embryonic versus wide/mature oceans, as well as the processes associated with their subduction and collision, characterize orogens. Second, we study how this variable orogenic inheritance may impact subsequent rifting.
Our results suggest that: (1) the margins from narrow/embryonic and wide/mature oceans are comparable, therefore the major difference between these end-members is the existence of a significant amount of normal oceanic crust; (2) subduction-induced processes significantly impact both the thermal state and the lithology/composition of the orogens that results from the closure of wide oceans; (3) orogenies subsequent to the closure of narrow oceans are essentially controlled by mechanical processes where the initial architecture of the rifted margin plays a dominant role; and (4) the difference in the composition of the mantle beneath these end-member orogens may account for the variability in the magmatic budget of subsequent extensional events, in particular, during orogenic collapse.