Summer Project 2017/2018

The evolution of continental rifts during supercontinent breakup and dispersal

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Continents periodically aggregate and disperse over a timescale of several hundreds of millions of years, in so-called Wilson Cycles. Continental fragmentation is associated with rifting (i.e the thinning of the lithosphere until it breaks). The process not only leads to the formation of new ocean basins, but also new pathways for ocean circulation and change in climate and surface environments. In addition, it affects global sea level change, by increasing continental area at the expense of the oceans, and at the same time submerging the rifted crust below sea level. The mature phase of supercontinent dispersal is characterised by consecutive continental collisions, which reduce the continental surface area via lithosphertic shortening and mountain building, also affecting global sea level.

The diffuse extension of plates via rifting is not accounted for in classic plate tectonic theory and conventional plates models. The recently released GPlates 2.0 software has changed this, which has allowed us to build a prototype of a global deforming plate model. This summer project is designed to use this model to quantify the characteristics of rifts through time in terms their widths and streching factors, while also quantifying the evolution of compressive deformation in terms of lithospheric thickening factors and how both plate thinning and thickening has affected surface (basement) topography through time, opening oceanic gateways or creating obstacles for atmospheric flow, changing regional circulation patterns, and making newly elevated topography at high latitudes prone to inland ice formation at high latitudes. The project will form the basis for subsequent coupling of time-dependent topography with surface process models, capturing how rifts are infilled with sediments and how young mountain chains are eroded as they form. The project is part of the Australian Research Council and industry-supported Basin Genesis Hub, and will lead to further research opportunities along the lines decribed above.

Prerequisites:

GEOS1001/1901 or GEOS1003/1903 and GEOS2124/2921 or GEOS2115/2915