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Mechanics of Forearc basins

In this study, the mechanics of forearc basins will be the object of a numerical investigation to understand the relationships between the wedge deformation and forearc basin formation. The aim of this work is to gain insight into the dynamics of the formation of the forearc basin, in particular the mechanism of formation of accommodation space and preservation of basin stratigraphy. Our tool is a two-dimensional numerical model that includes the rheological properties of the rock, including effective internal friction angle, effective basal friction angle, thermally-activated viscosity and strain softening. We also simulate different sedimentation rates in the basin, to study the influence of underfilled and overfilled basin conditions on the wedge deformation. Also the stratigraphy in the basin will be studied, because in undefilled conditions has been noted, the sediments can undergo tectonic deformation due to inner wedge deformation.

We compare the numerical model to basins along the Sunda-Java Trench. This margin shows a variety of structural and basin styles including underfilled and overfilled basins and different wedge geometries along the same trench. We interprete and document these structural styles, using depth migrated seismic sections of the Sunda Trench, obtained in three surveys, GINCO (11/98 – 01/99), MERAMEX (16/09/04 – 7/10/04) and SINDBAD (9/10/06 – 9/11/06) and made available by the IFM-GEOMAR group in Kiel and the Bundesanstalt für Geowissenschaften and Rohstoffe (BGR) in Hannover.

One important aspect of these margins that we document is the presence of a dynamic backstop, characterized by older accreted material, that although deformed during and after accretion, later becomes a stable part of the upper plate. We argue that, following critical wedge theory, it entered into the stability field of a wedge either by steepening or weakening of the underlying detachment. As a stable wedge, this older segment of the wedge acts as a mechanical backstop for the frontal deforming wedge. This dynamic backstop moves seaward in time, in response to isostatic loading by the growing wedge, or due to seaward retreat of the slab with a consequent steepening of the base of the wedge.