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Jurassic to Recent tectonic evolution of North America: A preliminary model using GPlates software

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Introduction

Using the paleo-GIS program GPlates, we have created a paleogeographic model for much of the North American Cordillera between 200 Ma and the present. Geofile2014-11 is a preliminary release of ongoing work to produce a paleogeographic model that best incorporates constraints from land geology (e.g., Dickinson and Lawton, 2001; Gabrielse et al., 2006; Wyld et al., 2006; Dickinson, 2008, 2013), paleolatitudinal information based on replicated paleomagnetic data with good paleohorizontal control (e.g., Enkin, 2006; Kent and Irving, 2010), and new geometric constraints on volcanic arc geometry from detailed mantle tomography (Sigloch et al., 2008; Sigloch and Mihalynuk, 2013). This release focusses primarily on plate movement in Canada (e.g., Monger et al., 1982, 1994; Mihalynuk et al., 1994; Gabrielse et al., 2006; Evenchick et al., 2007) and Alaska (e.g., Johnston, 2001; Mihalynuk and Sigloch, 2013), but also includes displacement and rotation of the Blue Mountains (Housen and Dorsey, 2005), Klamaths (Mankinen and Irwin, 1990), Salinian block-Transverse Ranges (McQuarrie and Wernicke, 2005), and Baja Mexico (Dickinson and Butler, 1998).

Geofile 2014-11 includes the following files:

1. HendersonEtAl Geofile2014-11 NAmericaPaleogeography200-0Ma.pdf (this text file).
2. HendersonEtAl Geofile2014-11 NAmericaPaleogeography200-0Ma.ppt (an annotated Powerpoint presentation including an animated tectonic model for the past 200 m.y. with a time slice every 2 m.y.).

GPlates open source software

GPlates is an open source GIS software (Boyden et al., 2012) with the added dimension of time. It permits tracking of tectonic plates or plate fragments (terranes) millions of years into the past. Data such as reconstruction poles and raster images can be imported directly into GPlates and used to constrain plate and terrane movements. Our model was created using GPlates 1.3.0 and 1.4.0.

Northern Cordilleran terranes

Terranes of British Columbia, Yukon, and Alaska were adapted from Colpron and Nelson (2011), while the Western U.S. terranes were adapted from Dickinson (2008) and Silberling et al. (1992).

Paleomagnetic constraints used in creating our model are median published paleo-inclination values. Using these latitudinal offset values, our reconstruction highlights the "Baja-BC problem" (e.g. Cowan, 1994) whereby the bulk of the Intermontane and Insular superterranes comprising Baja-BC (see slide 3 and Monger et al., 1982) lay offshore of the coupled Franciscan-Sierra Nevada accretionary complex-volcanic arc. It is argued that, in this configuration, the superterranes would have interfered with subduction of oceanic lithosphere necessary for creation of the accretionary complex and volcanic arc. Our next iteration of the model will address this problem, as well as the movement of other Western U.S. terranes and Siberia, and an alternative reconstruction of Arctic Alaska.

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