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Hildebrand Analysis: Topic 5

Accretion of exotic terranes in the late Paleozoic and early Mesozoic did not produce any changes in Hildebrand's North American shelf

Is there really nothing changing in the shelf at these times?

In trying to determine if there is any deformation occurring in the shelf during the late Paleozoic and early Mesozoic, it is important to define what "the shelf" really means in the context of this question. In Hildebrand's North America, the shelf would correspond to the Colorado Plateau. The issue with this definition is that there is no contention that there is a lack of deformation during the late Paleozoic and early Mesozoic. Deep-seated basement faults were reactivated during this time period and resulted in uplift in the region, but this isn't generally associated with the accretion of exotic terranes [Foos 1999]. A large amount of deformation in the Colorado Plateau is associated with the Laramide Orogeny that took place in the late Cretaceous to early Tertiary and has nothing to do with the accretion of the exotic terranes that we are interested in [Davis and Bump 2009].

Therefore, I contend that what is controversial in this topic is whether or not there is deformation in the Antler Shelf and Sevier Hinterland, located in central and eastern Nevada respectively. This portion of North America would need to have deformation in the classic model associated with exotic terranes since it acts as the edge of North America. The Colorado Plateau is located far inland, and I don't see a reason that classic exotic terrane models would require accretion this far off the edge of stable North America. The Sevier Hinterland is discussed in another topic, as such the Antler Shelf will be the focus of this section.

The lack of deformation in the Antler Shelf associated with late Paleozoic and early Mesozoic accretion is astonishing. Figure 1 [Wyld and Wright, 2001] shows the stark lack of magmatism leading up to the Jurassic. This would be atypical for an area with accretion so nearby. In attempting to look for exotic sediments in the area, my search came up dry. Both of these pieces of evidence strongly support Hildebrand's view of North America.

However, work that restores sediments to their original position in the Paleogene has revealed previously undiscovered fold structures in the Sevier Hinterland and Antler Shelf [Long, 2015] (Figure 2). These folds have Triassic sediments trapped within their hinges providing a maximum possible age of deformation and extend all the way out to the Roberts Mountain thrust (Figure 3). This allows for the possibility of these fold structures to be deformation associated with the accretion of exotic terranes in the early Mesozoic. This provides some evidence for the classic interpretation of North America, but it does not disprove Hildebrand's model.

Ultimately, Hildebrand has a good point that there is very little deformation associated with the accretion of exotic terranes in North America. One would expect heavy volcanism and features associated with collisions on stable North America if exotic terranes are slamming into the continent during the late Paleozoic and early Mesozoic. I don't believe that the traditional interpretation requires deformation in the Colorado Plateau as it is quite far away from the collisions, but I would expect more deformation than what has presently been discovered in the Antler Shelf.

Figures:

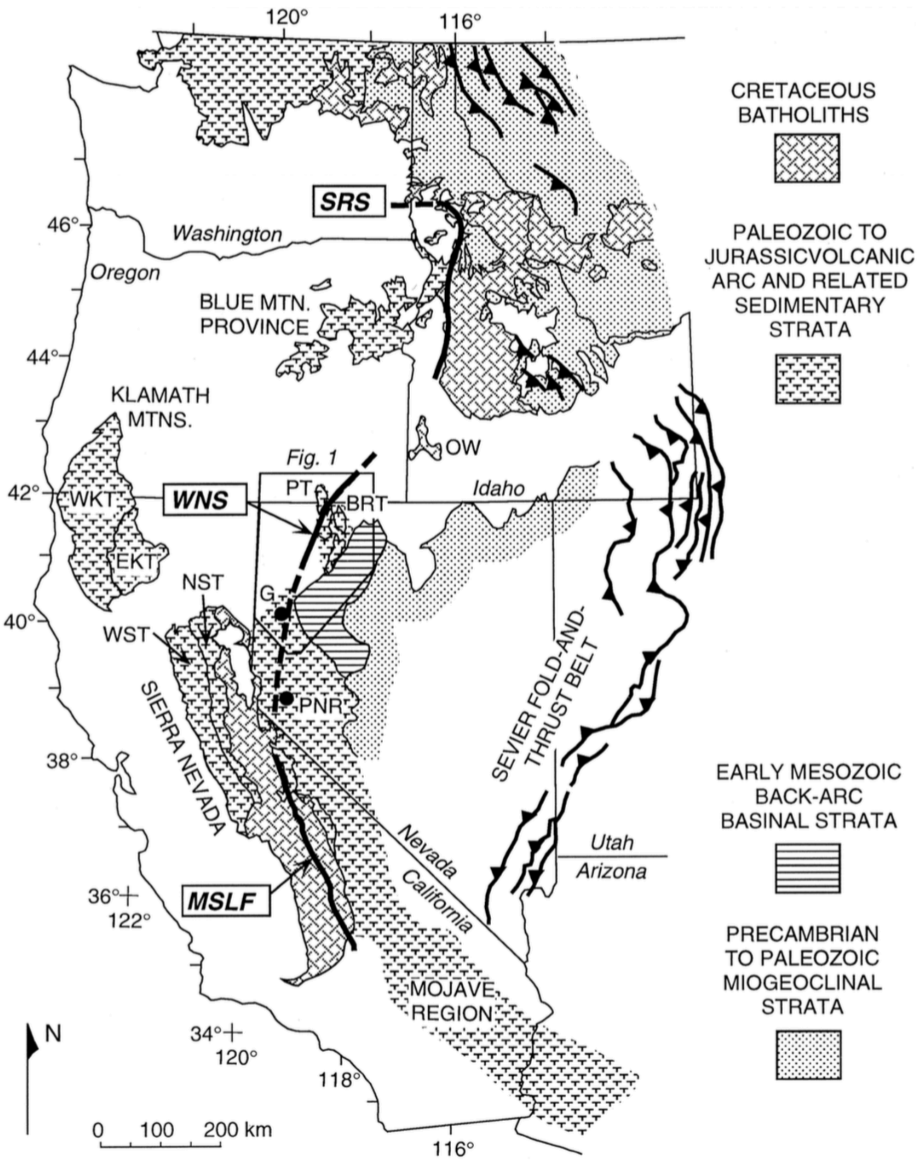

Figure 1: Generalized pre-Cenozoic geology of the western United States Cordillera. BRT is Black Rock terrane, EKT is eastern Klamath terrane, G is Gerlach area, MSLF is Mojave-Snow Lake fault (location from Schweickert and Lahren, 1990), NST is northern Sierra terrane, PNR is Pine Nut Range, PT is Pueblo terrane, OW is Owyhee County area, SRS is Salmon River suture zone (location from Manduca, Kuntz, and Silver, 1993), WKT is western Klamath terranes, WNS is western Nevada shear zone, and WST is western Sierra terranes. Location of MSLF, SRS, and WNS shown solid where known and dashed where inferred. (Wyld and Wright 2001)

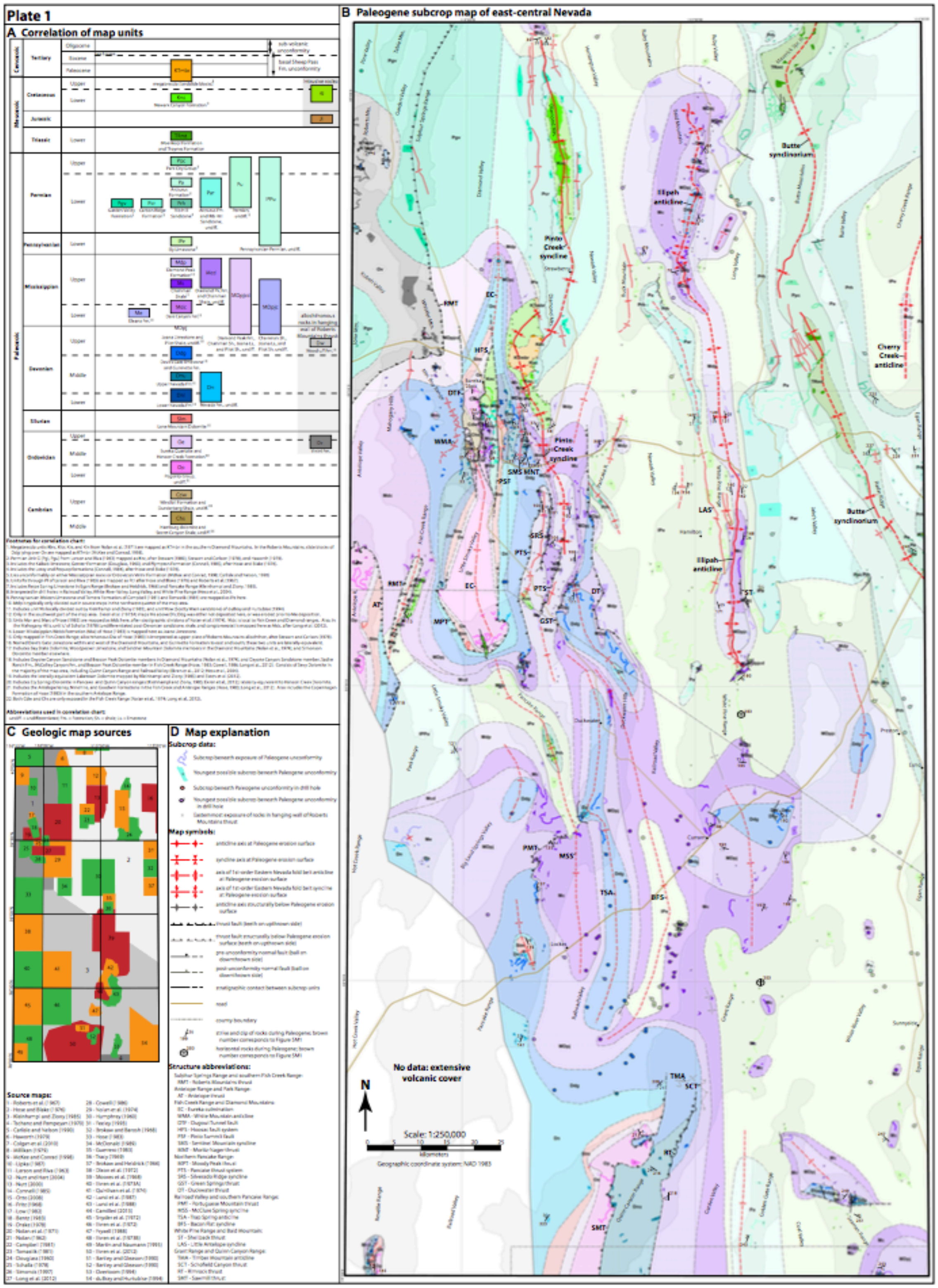

Figure 2: Paleogene subcrop map of east-central Nevada at 1:250,000 scale, with a correlation chart of map units, an index to geologic map sources, and an explanation of subcrop data, map symbology, and structure abbreviations. Strike and dip symbols show attitudes of rocks during the Paleogene, after retrodeformation of tilts of Tertiary rocks. (Long 2015)

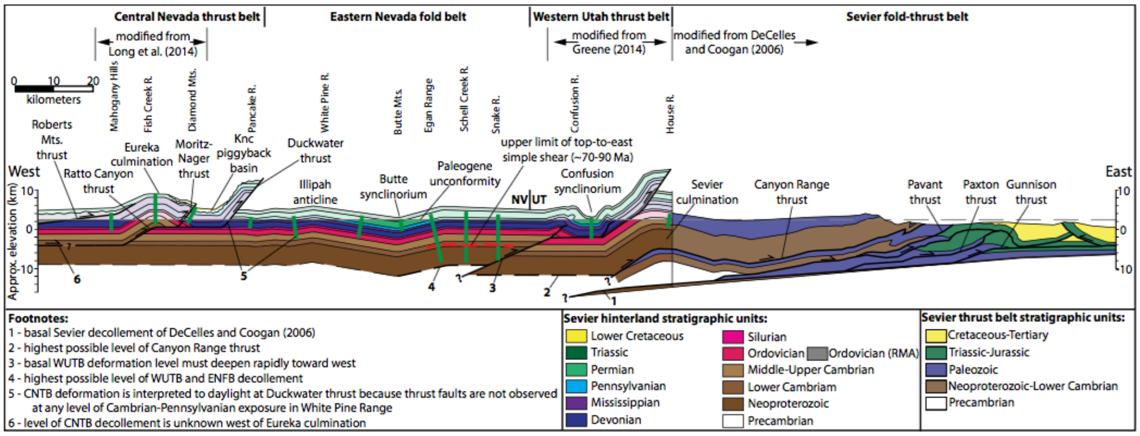

Figure 3: Generalized cross-section through eastern Nevada and western Utah at ~39°N, showing the geometry of the Sevier fold-and-thrust belt (modified from DeCelles and Coogan, 2006, their Fig. 8F), and structural provinces of the Sevier hinterland. This is not a balanced cross section; it is meant to illustrate approximate deformation geometries and constraints on décollement levels in the Sevier hinterland. (Long 2015)

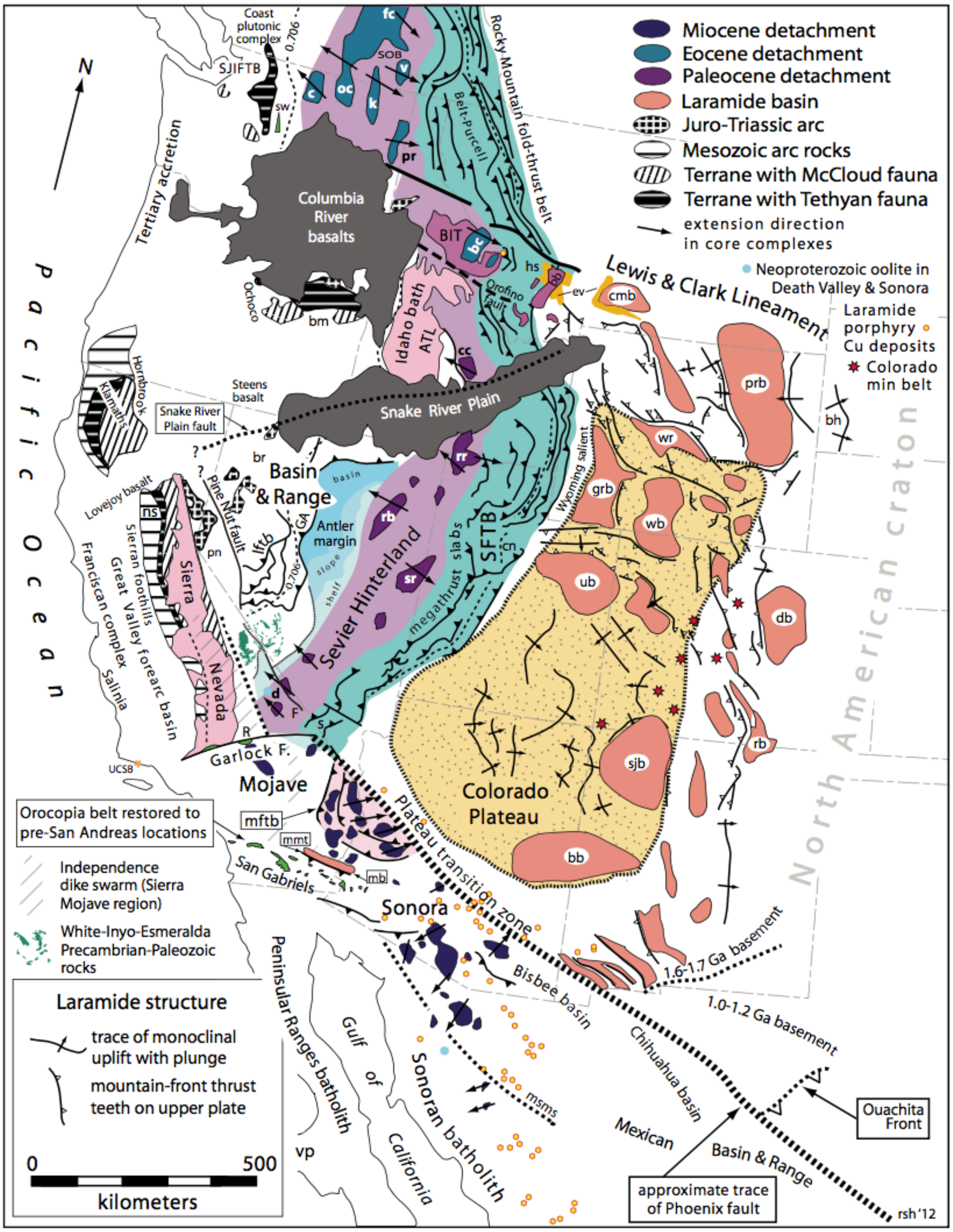

Figure 4: Geological sketch map of northwest Mexico, western United States, and southwesternmost Canada, illustrating the various tectonic elements discussed in Hildebrand's text. Approximate eastern limit of exotic allochthons marked by dashed line in thrust belt. Note that this is also the suture. Abbreviations and more information can be found in Hildebrand 2013.

References:

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