

Orogenic Remagnetizations in the Front Ranges and Inner Foothills of the Southern Canadian Cordillera: Chemical Harbinger and Thermal Handmaiden of Cordilleran Deformation

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EXPANDED ABSTRACT

Paleomagnetic studies of carbonate rocks in mountain belts have been helpful to the understanding of orogenic processes, the timing of deformation, and the nature of fluid flow in actively deforming foreland basins. Most studies on shallow-water carbonates indicate that their remanence is not primary, but rather they record remagnetization events contemporaneous with orogeny. By considering the remanent directions, fold test results, and rock magnetic properties, and tying these results to complementary structural, geochronological and geochemical studies, we are able to interpret deformation history, hydrological environment, and orogenic diagenesis.

We study the relationship between remagnetization and deformation of Paleozoic carbonates of the Front Ranges and Inner Foothills of the southern Canadian Rockies. The magnetic properties are remarkably constant along 500 km strike length, as sampled at 124 sites through 4 transects.

Primary Paleozoic remanent directions which would have shallow inclination, are never observed. Rather, the paleomagnetic signal is dominated by geographically persistent remagnetizations, characterized by steep inclination. As well as a soft present field overprint, we observed two distinctive secondary magnetizations, named the A and B components, carried by fine-grained magnetite.

Pervasive diagenesis induced the A component, a total chemical remanent magnetization. Poles for the A component are better concentrated after bedding correction indicating a pre- or early syndefor-

mational origin. With only one exception, the A component has normal polarity in the Front Ranges and reverse

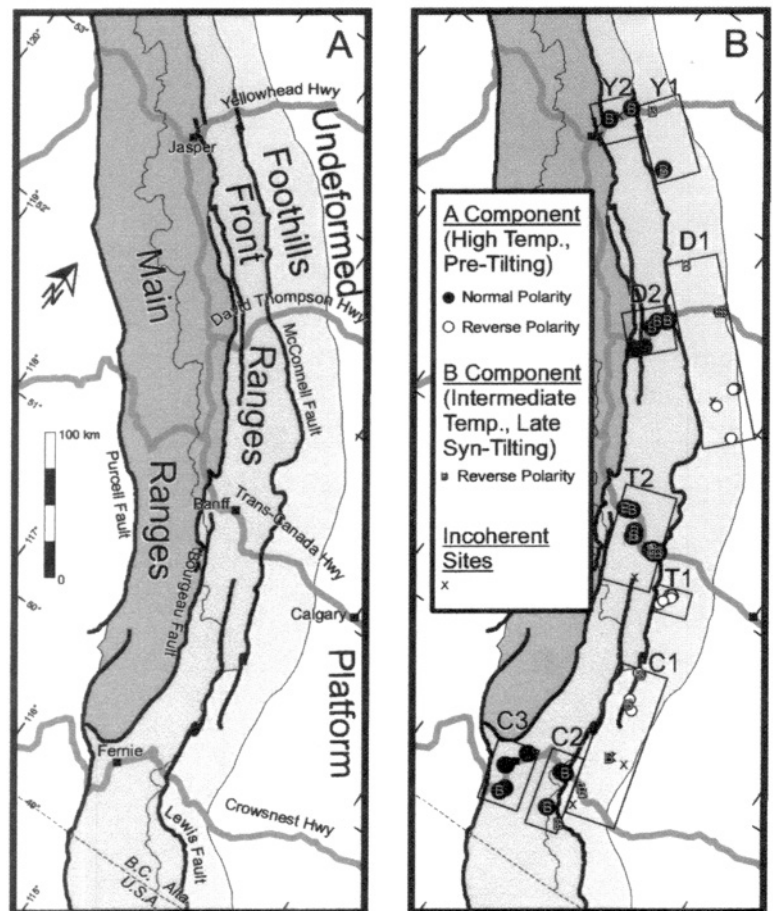


Figure 1.

polarity in the Inner Foothills. Pole positions, polarity, and geological and thermal constraints indicate that the A component was acquired diachronously in advance of the eastward migrating Cordilleran tectonic wedge.

Subsequently, an intermediate temperature partial thermo-remanent remagnetization, the B component, was superimposed on large regions of the Front Ranges and Inner Foothills. B component directions are brought into optimal concentration by differential untilting of 0% to

50%, indicating that the component was acquired after the rocks were incorporated into the orogenic wedge, but before the end of contractional deformation. The B component is strongest within a couple of kilometers of the frontal thrust of the Front Ranges. The relative magnitude of the B to A components and the maximum unblocking temperature of the B component decrease away from the frontal thrust over about 30 km, both to the west and to the east.

The B component thermal overprint was attained by <250°C heating in response to tectonic, or possibly sedimentary, loading. It was preserved by a rapid cooling accompanying a differential uplift and erosion of up to 8 km in the vicinity of the frontal thrust late in, or post-dating, its local tilting history. The likely cause was uplift of the exposed structural panel by contraction of younger underlying thrust structures.

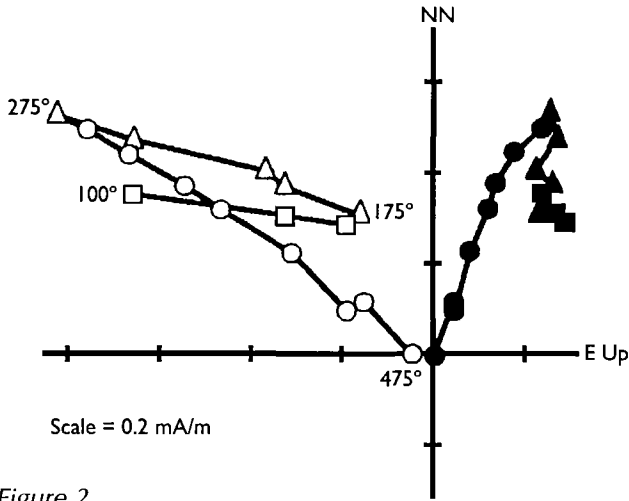


Figure 2.

Component A Poles
100% Untilted

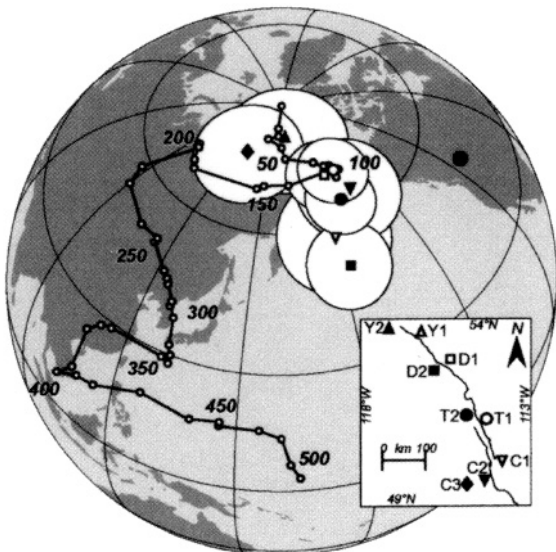


Figure 3.

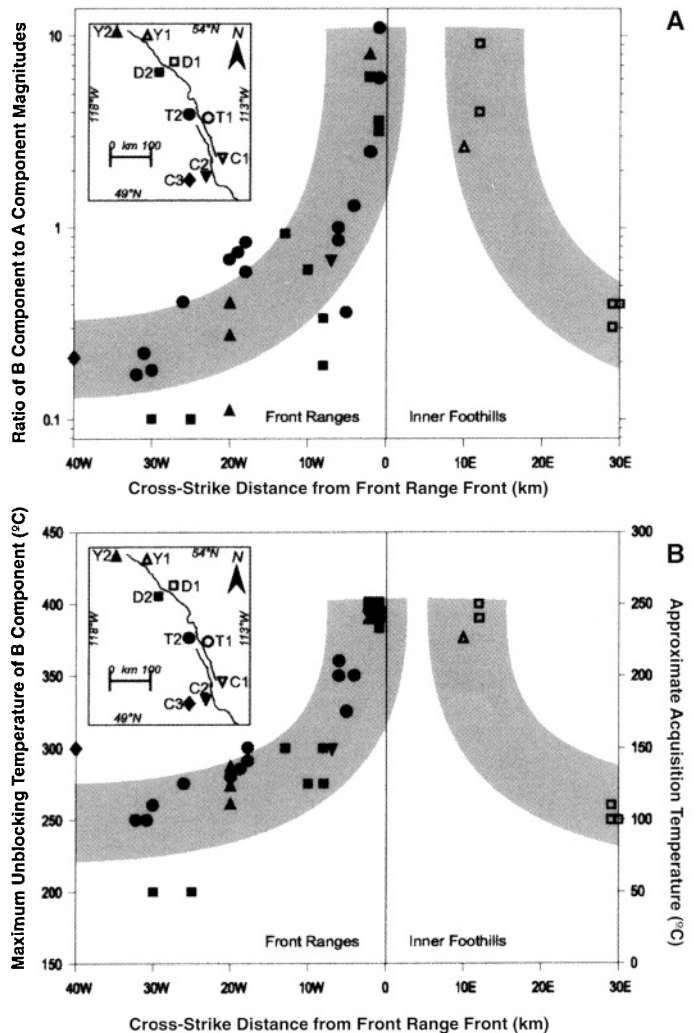
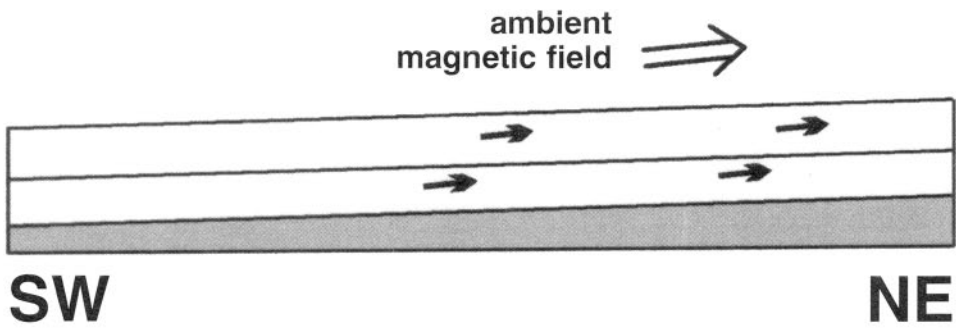
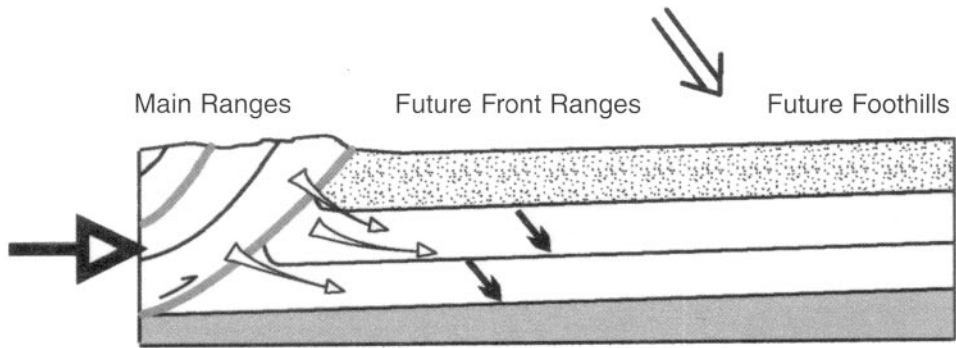


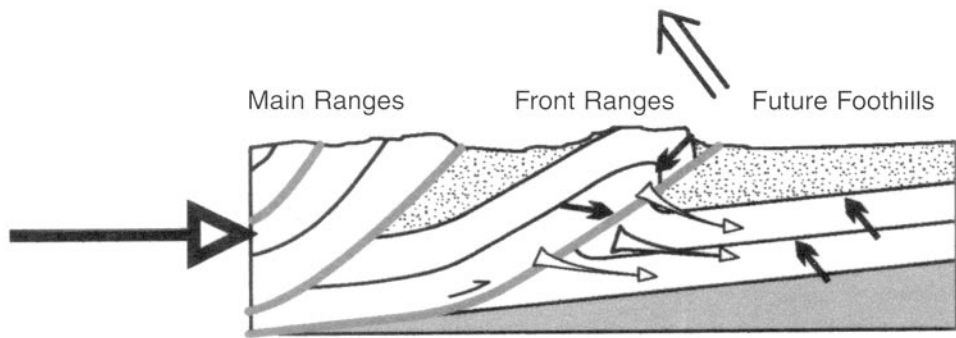
Figure 4.



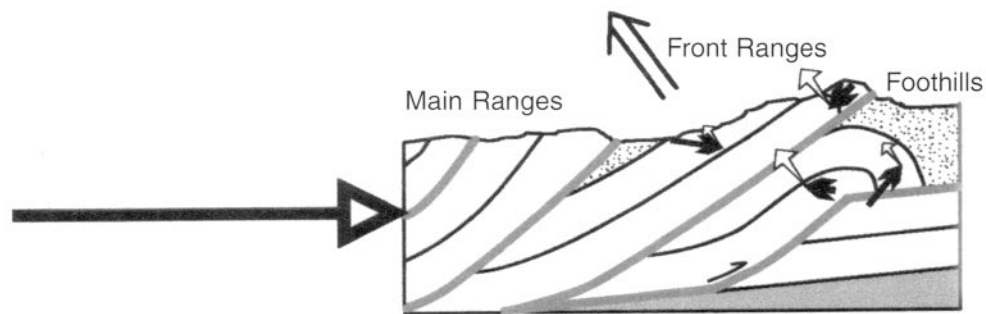
A) Primary Paleozoic remanence (totally lost by orogenic events)



B) A Component
 normal polarity chemical remagnetization acquired in flat-lying carbonates ahead of deformation front



C) A' Component
 reverse polarity chemical remagnetization in future Foothills. The A component in the Front Ranges is tilted with the strata



D) B Component
 late syn-deformational reverse polarity partial thermal remagnetization, quenched by uplift

Figure 5.