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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The remanent magnetization of Paleozoic carbonates in the Front Ranges and Inner Foothills of the southern Canadian Rockies is remarkably constant along 500 km strike length, as sampled at 124 sites through 4 transects. Primary Paleozoic remanent directions, which would have shallow inclinations, are never observed. Rather, the paleomagnetic signal is dominated by geographically persistent remagnetizations, characterized by steep inclinations. 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 remagnetization. Poles for the A component are better concentrated after bedding correction indicating a pre- or early syndeformational origin. With only one exception, the A component has normal polarity in the Front Ranges and reverse 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.