

this time is derived from 70–50 Ma accreted terranes such as the Crescent mafic complexes of western Canada. These terranes have geochemical and paleomagnetic data compatible with an origin as seamounts above the Yellowstone plume. Reconstructions indicate that the Crescent seamount was emplaced into oceanic crust that was 20–30 million years old and buoyancy flux calculations yield a value comparable to modern hotspots. Therefore a plume at the same paleolatitude as Yellowstone and with comparable or even greater vigour was responsible for generation of these seamounts. Such a plume would have generated a swell up to 2400 km in length and an oceanic plateau that would have been subducted as North America drifted westward in a hotspot reference frame.

Assuming the present distribution of hotspots and underlying plumes is representative of the past, then overriding of plumes and their buoyant swells at convergent margins should be common in the geologic record. This orogenic activity profoundly changes the geometry of subduction zones, and hence the style of orogenic activity, and may provide a unified interpretation for a number of individually enigmatic events associated with the Acadian orogeny in Atlantic Canada.

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**The missing record of subduction in ancient orogens:  
consideration of modern analogues**

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The record of subduction in ancient orogens is commonly interpreted by its style of magmatism, sedimentation, deformation, and metamorphism. However, in the circum-Pacific, about 10% of modern subduction zones are sub-horizontal. The Andean margin, for example, has several flat-slab segments, up to 500 km wide, that are each correlated with subduction of anomalously warm oceanic crust, represented by oceanic plateaux. Mesozoic–Cenozoic orogens, such as the Late Cretaceous–Eocene Laramide orogeny, have been ascribed to flat-slab subduction. These orogens are characterized by an absence of magmatism, widespread deformation, and thick-skinned tectonics up to 1000 km inboard of the plate margin, characteristics that are difficult to assess in ancient orogens. The origin of the flat-slab subduction is controversial, and several mechanisms may be responsible. In previous studies, we attributed the generation of the flat slab subduction associated with the Laramide orogeny to the overriding of an elongate swell and oceanic plateau associated with the ancestral Yellowstone hotspot. Reconstructions in a hot spot reference frame indicate that the Yellowstone hot spot was located beneath the oceanic Kula or Farallon plate until about 50 Ma. Evidence for the existence of the plume beneath the oceanic plate prior to