^{10}Be constrains the sediment sources and sediment yields to the Great Barrier Reef from the tropical Barron River catchment, Queensland, Australia

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Abstract

Estimates of long-term, background sediment generation rates place current and future sediment fluxes to the Great Barrier Reef in context. Without reliable estimates of sediment generation rates and without identification of the sources of sediment delivered to the reef prior to European settlement (c. 1850), determining the necessity and effectiveness of contemporary landscape management efforts is difficult. Using the ~2100-km2 Barron River catchment in Queensland, Australia, as a test case, we use in situ-produced 10Be to derive sediment generation rate estimates and use in situ and meteoric 10Be to identify the source of that sediment, which enters the Coral Sea near Cairns. Previous model-based calculations suggested that background sediment yields were up to an order of magnitude lower than contemporary sediment yields. In contrast, in situ 10Be data indicate that background (43 t km-2 y-1) and contemporary sediment yields (~45 t km-2 y-1) for the Barron River are similar. These data suggest that the reef became established in a sediment flux similar to what it receives today. Since western agricultural practices increased erosion rates, large amounts of sediment mobilized from hillslopes during the last century are probably stored in Queensland catchments and will eventually be transported to the coast, most likely in flows triggered by rare but powerful tropical cyclones that were more common before European settlement and may increase in strength as climate change warms the south Pacific Ocean. In situ and meteoric 10Be concentrations of Coral Sea beach sand near Cairns are similar to those in rivers on the Atherton Tablelands, suggesting that most sediment is derived from the extensive, low-gradient uplands rather than the steep, more rapidly eroding but beach proximal escarpment.

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