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Reading the sedimentary record in modern and ancient oceanic arcs

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Sediments deposited around oceanic volcanic arcs can provide a relatively complete, easily dated record of the evolving magmatism and tectonics of these active margins. This is especially true in tectonically erosive margins, where subsidence produces accommodation space for the preservation of the volcaniclastic strata. In order to yield a faithful record of arc development sediments must not experience major reworking, and must represent the contemporaneous volcanism at the time of their deposition of a relatively restricted part of the arc. Along strike variations in volcanic chemistry can cause a chaotic record if tephra from long sections of the arc are all deposited together. We employ new seafloor imaging of the Mariana and Tonga Arcs, as well as mapping of the most complete ancient arc crustal section known, the Lower Jurassic Talkeetna Formation of south-central Alaska, to understand how volcaniclastic sediment is dispersed around oceanic arcs. All three arcs formed in tectonically erosive margin settings, resulting in long-term extension and subsidence. Debris aprons composed of turbidites and debris flows occur in the immediate vicinity of arc volcanoes, forming relatively continuous mass-wasted volcaniclastic records, which could be used to reconstruct the evolution of a given volcanic center. There is little erosion or reworking of volcanic materials near the arc volcanic front, except for slumping on the upper slopes of the edifice. Towards the trench and the outer arc high sediment records are less complete and include material reworked from older arc sediments, making them poor proxies of arc activity. Arc sedimentary sections in erosive plate margins can provide good records of volcanism and tectonism spanning $<$10 my. Long-term tectonic erosion results in gradual migration of the forearc basin crust and its sedimentary cover

toward the trench, where there is little volcanic sedimentation. Tectonically generated topography in the forearc effectively blocks sediment flow from the volcanic front to the trench; although some canyons deliver sediment to the trench slope, most volcanic sedimentation is limited to the area immediately around volcanic centers.