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Controls on the Flux of Sedimentary Carbon to the Mantle since the Cretaceous

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Quantification of the long-term cycling of carbon from the mantle to the surface remains contentious despite its importance in governing the climate and biosphere of Earth. Sedimentary organic and carbonate carbon represents a significant part of the budget and can be returned to the mantle if it reaches subduction zones and is not offscraped and preserved in an accretionary prism. I estimate that ~60 Mt/yr is presently being subducted below forearcs. 80% in the form of carbonate, significantly more than previously estimated. Sedimentary carbon represents around two thirds of the total carbon input at the trenches, with the rest being in the igneous crust. An additional 7 Mt/yr is averaged over the Cenozoic as a result of passive margin subduction during continental collision. This revised budget estimates the input and output fluxes within the range of uncertainties, compared to earlier deficits. Degassing from arc volcanoes and in forearcs totals ~55 Mt/yr. A net modern carbon flux to the mantle is probable but this may only date from the Jurassic when biogenic carbonate production increased. The efficiency of carbon subduction is largely controlled by the carbonate contents of the sediments, and is partly linked to the latitude of the trench. Accretionary margins are the biggest suppliers of carbon to the mantle wedge, especially Java, Sumatra, Andaman-Burma and Makran because the offscraping is inefficient and the thickness of the trench sediment and trench length are both large. The Western Pacific trenches are negligible sinks of sedimentary carbon.