

Low-latitude arc–continent collision as a driver for global cooling

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New constraints on the tectonic evolution of the Neo-Tethys Ocean indicate that at ~ 90–70 Ma and at ~ 50–40 Ma, vast quantities of mafic and ultramafic rocks were emplaced at low latitude onto continental crust within the tropical humid belt. These emplacement events correspond temporally with, and are potential agents for, the global climatic cooling events that terminated the Cretaceous Thermal Maximum and the Early Eocene Climatic Optimum. We model the temporal effects of CO₂ drawdown from the atmosphere due to chemical weathering of these obducted ophiolites, and of CO₂ addition to the atmosphere from arc volcanism in the Neo-Tethys, between 100 and 40 Ma. Modeled variations in net CO₂-drawdown rates are in excellent agreement with contemporaneous variation of ocean bottom water temperatures over this time interval, indicating that ophiolite emplacement may have played a major role in changing global climate. We demonstrate that both the lithology of the obducted rocks (mafic/ultramafic) and a tropical humid climate with high precipitation rate are needed to produce significant consumption of CO₂. Based on these results, we suggest that the low-latitude closure of ocean basins along east–west trending plate boundaries may also have initiated other long-term global cooling events, such as Middle to Late Ordovician cooling and glaciation associated with the closure of the Iapetus Ocean.