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Insights into the tectonic and climatic evolution of West Antarctica from the Amundsen Sea sediment record

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West Antarctica hosts one of the largest continental rift systems on earth. Due to the extensive ice cover and the lack of exposed sedimentary rocks, little is known about the detailed geological and climatic evolution of West Antarctica. Here we present initial geochronologic, petrographic, stratigraphic, palynologic and clay mineralogy data of the first drill cores from the Amundsen Sea, off West Antarctica. The drilled succession revealed fine-grained, plant-bearing sediments of late Cretaceous age (∼93 to 85 Ma), deposited during continental stretching and breakup between West Antarctica and New Zealand. The Cretaceous deposits are separated by a peat layer from coarse-grained sandstones, which contain zircon and apatite yielding U-Pb ages of ca. 46-39 Ma. This implies a hiatus of at least 40 Myr between the fine-grained Cretaceous deposits and the overlying sandstones, which is in agreement with the absence of in-situ or reworked Paleocene to early/mid-Eocene palynomorphs. We tentatively interpret this hiatus as reflecting tectonic quiescence and slow downwearing, or non-deposition. This interpretation supports our previous thermochronological data from the onshore realm, which show that extension-related exhumation ceased at the end of the Cretaceous. We interpret renewed deposition during the upper Eocene to Oligocene to reflect renewed rapid exhumation along the West Antarctic Rift System and the rise of the Transantarctic Mountains. As well as the Eocene dates, the Eocene to Oligocene sandstones contain Cambro-Silurian, Permo-Triassic, Early Jurassic and Cretaceous apatite U-Pb age groups, which we interpret as derived from the Transantarctic Mountains (igneous and metamorphic rocks of the Cambro-Ordovician Ross Orogeny, and volcanic rocks related to the Early Jurassic Ferrar volcanic event) and Marie Byrd Land / West Antarctica (Permo-Triassic magmatic arc and widespread Cretaceous batholiths). Unusual for this kind of lithology, the sandstones' apatite yield is low, and lattice defects of apatite grains frequently show etching features. Cretaceous rhyolite clasts, abundant in the sandstones, are sometimes heavily kaolinized, and the clay fraction of the sandstones contains up to >70% kaolinite. All these features, along with the results of palynology, imply an acidic, swamp-like deposition environment characterised by moderate to strong chemical weathering, and a temperate climate with warm intervals, becoming cooler towards the Oligocene.