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Diatom ooze as weak layer for submarine mega-slides off Northwest Africa: Evidence from core-seismic integration in the Cap Blanc Slide area

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The continental slope off Northwest Africa has experienced at least four mega-landslides, each affecting over 20,000 km^2 of seafloor. Although the landslides lie more than 400 km apart, they have many similar characteristics, including stepped headwall patterns and several bedding-parallel glide planes at slope angles of <2°. This morphology suggests that failures took place along multiple mechanically weak sedimentary layers that are present at different stratigraphic depths. From all Northwest African mega-landslides the Cap Blanc Slide, situated off the coasts of Mauretania and West Sahara, offers an unprecedented possibility to advance our understanding of landslide causes. ODP site 658 (Leg 108) was drilled within the evacuation area of the slide, recovering its glide plane. In addition, site 658 also recovered the glide plane and the overlying undisturbed sedimentary sequence of a younger slope failure, which took place within the evacuation are of the main Cap Blanc Slide at some distance to the borehole. We use core-seismic integration to characterize the glide planes as well as to determine the timing of slope failures. The sediments just above both glide planes have particularly high biogenic opal contents owing to the presence of large amounts of diatom microfossils. Diatoms are hollow structures of microfossil skeletons, which contain large amounts of bound and intraskeletal water. When a critical stress level is exceeded during compaction, the microfossil shells break. The stored water is released causing a sudden increase in pore pressure, which may facilitate slope failure. We therefore suggest that diatom oozes acted as weak layers in the case of the Cap Blanc Slide. Pronounced biogenic opal maxima occur during glacial terminations and are expected all along the Northwest African continental margin. We thus hypothesize that mega-slides off Northwest Africa, and potentially also at other continental margins, are preconditioned by episodically high deposition of biogenic opal.