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Mapping and Modelling of seabed morphology - the PNG Slump – 3-D Evidence to Demonstrate a Tsunami Source?

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The original offshore data set for the slump that is now generally accepted as the source of the 1998 PNG tsunami was originally presented as 2-D bathymetry images, seismic sections and as seabed photographs. The dataset images a cohesive rotational failure offshore off the north coast of Papua New Guinea, mathematical modelling of which provides appropriate run-ups comparable with onshore measurements from field surveys.

The regional bathymetry and seismic data acquired off the north coast of PNG images a deeply incised, sediment-starved convergent margin subsiding along the New Guinea Trench. An arcuate shaped feature off the Sissano Lagoon, termed the ‘amphitheatre’, is identified as the source location of the failure that is located in the east of this feature. The presence of a slump in this eastern area is confirmed by seismic data and observations from Remote and Manned Submersibles, that show seabed features, such as fissures and fractured limestone, on the surface of the slump and interpreted as due to sediment movement.

Absolute dating of slump failure is not possible with the present data set, but the relative, recent, age of failure is based on the fresher appearance of fissures in the slump area as well as a greater concentration of a chemosynthetic cold-water biota together with active fluid expulsion on the slump surface. The chemosynthetic biotas comprise mussels and tubeworms and bacterial mats. Laminar bedded chemosynthetic

limestone was only observed on the slump surface and represents a low volume background sulphide and methane rich fluid seepage. The concentration of living cold-water faunas on the slump surface is interpreted as the result of an increased fluid expulsion rate associated with the slumping.

This presentation uses new interactive software, Fledermaus, to image the northern PNG offshore area, including the amphitheatre, to show the seabed morphology in 3-D and the relationships between the regional geology and the slump area. Use of this software allows the integration of the surface morphology and the subsurface seismic data together with the seabed images, allowing a better understanding of the region and its tsunamigenic potential.