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Geological and oceanographic controls on seabed fluid escape structures in the N. Zhongjiannan Basin, South China Sea

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Fluid escape structures including mega-pockmarks and mud volcanoes are found extensively in the N. Zhongjiannan Basin, S. China Sea. Individual pockmarks are circular, elliptical, crescent-shaped or elongated, with diameters ranging from 100s to 1000s meters and 10s or 100s meters in depth, forming groups or strings. Crescent pockmark (often forming strings), are more widespread and unique in this area than anywhere else. It is proposed that they experienced a 5-stage formation process, implying as possible controlling factors gravity sliding/slumping, fluid escape activity and sandbodies intrusions. Elongated pockmarks, pockmark gullies and gullies are generally controlled by underlying buried channels and gullies and gravity sliding/slumping. Conical mud volcanoes (groups) mostly with kilometer-wide diameters and ca. 100 m high have likely undergone two episodes of evolution. Mega-pockmarks, collapse structures and blind valleys have formed at the apexes of tectonic uplifts related to volcanism and above basement highs. Bottom currents associated with the South China Sea Western Boundary Bottom currents, eddies and turbidite currents likely play an important role in sediment remobilization, sediment transport and can explain the observed asymmetric morphologies of the fluid escape structures.
Regional uplift and volcanism took place near the Palaeogene–Neogene boundary and, during the Neogene–Quaternary post-rift thermal subsidence period, differential subsidence and diapirism deformed the overlying kilometer-scale successions. Mainly after the Miocene, focused flow of fluids originated at depth occurred along gas pipes, polygonal faults, tapered reflectors and faults into the shallow sediments, resulting in intense fluid blowouts and complex fluid escape structures at the seafloor. Seismic data strongly suggests that some of these structures are still active, as indicated by fluid pathways that reach the seafloor and plumes observed in the water column, indicating a unique and extensive seepage region in the South China Sea.