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Pockmark formation and modification processes on the Canterbury Shelf, New Zealand

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Escalating demands for water in coastal areas and the effects on coastal environments have significantly increased scientific interest in submarine groundwater discharge (SGD) over the last decade. Submarine hydrocarbon seeps also attract much interest because of their relevance to hydrocarbon exploration and the specific micro-environment they create at the seafloor, characterised by specialised bacterial and faunal activity, mineral precipitation and their effect on overlying water-column dynamics. Active seepage of both groundwater and gas through shelfal sediments can result in the formation of seafloor pockmarks and induce sediment instabilities that can lead to submarine landslides and tsunamis.

On the passive continental margin south-east of New Zealand's South Island, numerous north-eastward facing, crescent-shaped pockmarks form on the slope at depths between 500 and 1000 m. Their elongated form correlates to the predominant north-eastward flowing Southland Current, which seems to modify the pockmarks after their formation. Bathymetry data acquired during Tangaroa cruise 1703 in 2017 also revealed widespread pockmark formation on the Canterbury Shelf (<130 m) indicating shallower fluid seepage on the margin. Water column imaging techniques revealed acoustic anomalies potentially related to gas and/or groundwater vents on the seafloor. The shelfal pockmarks show predominant circular morphologies, while several exhibit a south-westward facing crescent shape.

We present the results of recent follow-up investigations into the nature of the crescent-shaped pockmarks and the acoustic water column anomalies. Repeated water column imaging surveys will determine the temporal and spatial variation of the acoustic anomalies identified during the 2017 cruise.
High-resolution bathymetry and backscatter data, as well as airgun seismic data, high-resolution boomer seismic data and sub-bottom profiler data, complement our investigation of subsurface geological mechanisms for pockmark formation, modification, and distribution on the Canterbury Shelf.