High Velocity = High Prospectivity? A Seismic Window into Southeast Tasmania's Natural Hydrogen Potential

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Natural hydrogen has the potential to provide a new, clean energy source that may substitute for fossil fuels in many applications. Initial studies into natural hydrogen formation implied that resource generation required a set of complex and rare geological conditions, but more recent observations have indicated the potential for hydrogen to be a far more common occurrence throughout the Earth's crust, particularly in association with traditional hydrocarbon plays. In this study we present the results of a passive seismic imaging study to assess the potential for a natural hydrogen resource beneath north Bruny Island in south-east Tasmania. We use ambient noise surface wave tomography to create a 3D S-wave velocity model of the top 2 km of the Earth's crust beneath Bruny Island and image the geological structure of the thick Paleozoic sedimentary basin that constitutes the island. Our S-wave velocity model clearly distinguishes between the thick Permian – Triassic sedimentary sequence in the northern part of the island, and the thinner sediments in the south. Most notably, we have discovered an elongate high S-wave velocity structure located ~1800 m beneath the south-eastern portion of the island, that we interpret as a large section of up-lifted metamorphic basement rocks of likely Proterozoic age. In addition, we image several probable fault structures affecting the basement rocks that are likely the result of the extensional tectonic regime that affected Tasmania between late Cretaceous – Paleocene.