# Fluid venting at a Cretaceous seamount, Canary Archipelago

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Henry Seamount is a 8-km-wide, 660-m-high edifice rising from 3700 m deep seafloor southeast of El Hierro, the youngest of the Canary Islands (1.1 Ma). Sonar and seismic data revealed that the seamount is an old volcano with radiating gullies and a sediment cover of several meters (Gee *et al.*, 2001). Dredging during Meteor cruise M66/1 in 2005 recovered (i) slightly to heavily altered trachyte fragments covered by thin Mn-crusts; (ii) a fresh porous barite block overgrown by a coral stem; (iii) abundant shell fragments of vesicomyid clams up to 15 cm in size; and (iv) soft sediments and sediment rocks.

The trace element compositions of the trachytes indicate an origin by intraplate rather than ridge volcanism. Ar/Ar dating of feldspars and matrix of two trachyte samples gave an age range of 123.8 to 126.4 Ma, which is considerably older than any of the Canary Islands. The combined morphological and age data support the interpretation of Henry Seamount being an extinct volcano.

The recovery of shells from vesicomyid clams at Henry Seamount is surprising since this species is always associated with hydrothermal vents or seepage. $^{14}$C dating of two shells gave ages of 3.4 and 18.6 ka consistent with Recent venting activity. Fluid discharge at Henry Seamount is also indicated by the recovered barite block having $\delta^{34}$S values between 26.5 and 31.8 ‰ and $\delta^{18}$O values between 14.1 and 16.9 ‰. To our knowledge, this is the first reported finding of vesicomyid clams within the Canary Archipelago and also the first direct or indirect evidence of fluid venting in this area.

How can Recent fluid venting at Henry Seamount be reconciled with its early Cretaceous age? We propose that hydrothermal circulation within the Jurassic oceanic crust around El Hierro is driven by a mechanism similar to that proposed for young crust of the Juan de Fuca ridge flank (Fisher *et al.*, 2003), the ultimate heat source being the hotspot beneath the western Canary Islands. Henry Seamount may thus work as a "breathing hole" where fluid discharge is facilitated by a rather thin sediment layer compared to the adjacent seafloor covered by thick impermeable sediment. Recharge may occur at adjacent basement outcrops such as the flanks of El Hierro island. Our results indicate that hydrothermal circulation through seamounts is not confined to young warm ridge flanks but may be a widespread phenomenon on the ocean floor.

## References

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# Unfractionated excess air: The result of incomplete dissolution of entrapped air?

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Dissolved atmospheric (noble) gases in groundwater usually exceed their respective atmospheric equilibrium concentrations. This phenomenon is usually referred to as “excess air” in groundwater hydrology.

The formation of excess air has been suggested to result from the (partial) dissolution of entrapped air within the quasi-saturated zone. Excess air in groundwater crucially hampers the interpretation of environmental tracer data. Therefore, several lumped parameter models have been developed to parameterize the excess air component, which can then be separated from the total measured gas concentrations. However, these models do not include a mechanistic description of the gas exchange in porous media.

Excess air can be either unfractionated, i.e., the elemental composition is atmospheric, or fractionated with respect to atmospheric air. The most simple lumped parameter model was introduced by Heaton and Vogel (1981) and proposes the complete dissolution of entrapped air, leading to unfractionated excess air. Although most groundwater samples contain fractionated excess air, unfractionated excess air is also found. However, the amounts of entrapped and completely dissolved air proposed by the unfractionated excess air model are usually much smaller than typical values of entrapped air volumes observed in the field or in laboratory experiments.

Based on new experimental results and numerical investigations, we present an alternative conceptual model for the formation of apparently unfractionated excess air in the presence of a progressively dissolving entrapped gas phase. This new approach is of particular interest for the interpretation of environmental tracer data (e.g., determination of paleo-soil temperature using noble gases) and for the potential use of excess air as a proxy for the hydraulic conditions prevailing during groundwater recharge.

## Reference

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