

Overview of saline water problems in small volcanic islands

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ABSTRACT

There are many small volcanic islands, up to 3000 km² of surface area, that generally have high altitudes and may present high coastal cliffs. There is a wide variety of geological conditions and volcanic rock compositions, from basalt–dominated hot spot islands to rhyolitic arc–islands, some with Holocene volcanism and other with several million years old volcanism. Often they have a complex structure around a central caldera on materials rising from the sea floor and later on covered with more recent volcanic materials. Intracaldera and extracaldera formations may be hydrogeologically quite different and a low permeability core may be present. Some are still growing while others are in an advanced erosion stage, have lost most of the initial highlands and the old magma chambers may be exposed. This has to be combined with the important influence of climate on recharge water salinity, and the addition of deep volcanic CO₂ in some areas. Conditions along the coast are highly variable, from almost marine water free, low permeability formations to high permeability recent volcanic and volcanoclastic deposits, one of the most permeable geological formations, which means marine water at shallow depth, penetrating deeply into the island. Under favourable conditions, slope, torrential and pyroclastic deposits of different kinds may confine volcanic aquifers in some coastal areas. Common seawater–freshwater relationships apply but often there are thick mixing zones and conspicuous heterogeneity. Some different cases are commented with special emphasis on the Canary Islands, where climatic–generated salinity is also a coastal characteristic.

