

Abstract

Basalt is a fine grained, sometimes glassy basic igneous rock that makes up more than 90% of volcanic rocks. Although basalt makes a good aquifer under the Earth's oceans, this report concentrates on those aquifers of potentially potable water. Two main settings are identified - basalt plateaus and oceanic islands. Both are typified by having basaltic aquifers as the only source of water.

Basalt genesis is discussed in detail as it is during the processes of lava cooling and lithification that the water bearing structures are formed. The occurrence and development of water from these structures is described qualitatively and then methods of quantifying the aquifer's hydrogeologic properties discussed. There is scope for further development of analysis of pump tests in basaltic aquifers. Mechanisms of recharge, both natural and artificial are considered, the latter having only been attempted in the United States, but with reasonable success.

Basalt hydrochemistry has been researched quite extensively by two approaches. Firstly, some authors have considered element mobility in the basalt weathering process and secondly, others have taken a mineralogical approach. The first method has not produced consistent results and the second is unresolved as to a single primary phase controlling water chemistry. Computer modelling has found calcite, clay and zeolite minerals in equilibrium with the water. These secondary minerals must control the concentration of Si, Al, Mg, Fe, Na and K in cases where the minerals have been identified in the rock. Point, linear and diffuse source contamination of basaltic aquifers is reported on Hawaii, but basalt secondary mineralogy may help retard contaminant transport. Small contrasts in basalts' physical properties does not allow widespread use of geophysical methods, however, limited applications are described.