Noble gas signatures on the island of maui, Hawaii – developing a new Noble gas application in fractured groundwater systems

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Recent work in the Galapagos Islands suggests that noble gas temperatures (NGTs) in fractured groundwater systems reflect the temperature of the ground surface at the time of infiltration rather than the mean annual air temperature (MAAT) value as commonly assumed in sedimentary systems where NGTs are typically used as indicators of past climate. This suggests that noble gases in fractured areas may record seasonality, and thus, provide information about timing of recharge in addition to location. Calculation of NGTs assumes that rain-derived recharge at the water table is in equilibrium with ground air. Lack of noble gas equilibration with respect to surface conditions, however, was observed in high-altitude springs in the Galapagos Islands and in a rainwater pilot study in Michigan, supporting the NGT seasonality hypothesis. Developing this new NGT application will lead to a better understanding of fractured groundwater flow systems and will contribute to improved water resource management plans.

This study, carried out on Maui, Hawaii, is meant to test these hypotheses while improving knowledge of this island's groundwater flow system where limited hydrologic data are available. Here, we present the first results of noble gas analyses from samples collected in springs, groundwater wells and rainwater on northeast Maui. Results show that like most Michigan rainwater samples, rainwater from Maui is in disequilibrium with surface conditions and follows a mass-dependent pattern. Spring samples follow a similar pattern to that of rainwater and suggest that spring water originates directly from rainfall. These findings further support the hypothesis of NGT seasonality. Overall, preliminary results indicate that noble gas signatures in Maui reflect the source of recharge rather than the expected altitude/temperature relationship commonly observed in sedimentary systems.