Origin of geothermal fluids in the shallow environment of an emergent volcano – Savo, Solomon Islands

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Savo (Solomon Islands) is a recently emergent volcano in the central Solomon Islands. An active geothermal system has been present there for at least 50 years, expressed at the surface by numerous hot springs, fumaroles and areas of steaming ground. During a 2005 field campaign, samples of water and steam were collected from geothermal features and non-thermal springs and wells, and representative samples of altered rocks and geothermal precipitates were collected from geothermal areas.
Analysis of the waters for anion, cation and stable isotope composition shows that the waters discharging to the surface fall into two groups.

	Rembokola Type	Reoka Type
Temperature (°C)	102	100
pH	8.2	2.5
SO_4^{2-} (ppm)	653	516
$\delta^{34}S_{SO4}$ ‰	+5.7 ±1	-2.9 ±1
Cl^- (ppm)	50	4
Al (ppb)	<350	827
Ca (ppm)	129	58
Fe (ppm)	<0.1	24
Na (ppm)	220	45

The Reoka Type fluids have the high sulphate, low pH, and enriched $\delta^{18}O$ and δD values typical of steam heated acid sulphate waters, where shallow groundwater is heated by rising steam and gas. Hydrogen sulphide is oxidised in the near surface environment to produce the sulphate content and native sulphur sublimates. The host rocks and/or sediments for Reoka Type fluids are typically altered to kaolinite with alunite, gypsum and barite.
Rembokola Type fluids have chemistry distinct from the Reoka Type fluids, despite the two being found in hot springs within close proximity. Rembokola Type fluids are often produce a carbonate sinter, so are assumed to be saturated with bicarbonate. The aqueous sulphate has a heavy $\delta^{34}S$, suggesting that the source of sulphate is not exclusively the oxidation of hydrogen sulphide gas or sulphide minerals in the near surface environment. We suggest that condensation of volcanic gases (dominantly water vapour but including carbon dioxide and isotopically heavy sulphur dioxide) into meteoric-derived groundwater in the upper levels of the volcanic edifice produces these carbonate-sulphate waters. The presence of sulphur dioxide at high levels in the volcanic edifice suggests that there is a degassing magma at depth, and potentially a high sulphidation-type epithermal system beneath the steam heated zone.