



West Virginia Geological and Economic Survey

Colloquium Series

Presenting

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Date: **Monday Feb 4th 2008**

Place: **Large Conference Room**

Refreshments: **cookies if you come early**

Presentation: **Begins at Noon**



Large intra-caldera vents Marum (left) and Benbow (right rear) viewed from the north. Plumes above each vent feature a high degree of condensation and SO₂ gases. Image: Kelby Hicks.

Effects of Elevated pH Levels Resulting from Persistent Volcanic Degassing of SO₂ on Ambrym Island, Vanuatu

(Including Accounts of Working in the Cannibal Islands)

Ambrym volcano, Vanuatu, is known historically for emitting huge amounts of volcanic gases. In early 1995, NASA determined Ambrym provided the highest single source of sulfur dioxide (SO₂) emissions on Earth. Ambrym was visited from the 25th May - 12th June, 2007, to measure SO₂ emissions and determine hazards resulting from associated acidified deposition. Current activity on Ambrym is concentrated within the two large cones of Marum and Benbow with both cones exhibiting continuous strong degassing of SO₂, light ash and tephra emissions, and in the case of Marum, a violently degassing lava lake. On the 9th of June, emissions of 6389 t/d SO₂ were measured using a FLYSPEC UV spectrometer mounted on a light aircraft. These high SO₂ levels indicate the presence of large amounts of other volcanic gases (CO₂, H₂O, F, Cl, etc). The emission of these gases directly results in deposition of hydrochloric, hydrofluoric and sulfuric acids proximal to the volcanic plume. In humans, acidified deposition can cause blistering of the lips, raw or burning throats, flesh burns, hair loss, and gastrointestinal distress. Indirectly, acidified deposition creates hazards resulting from the ingestion of waters contaminated with heavy metals as a result of metal corrosion, and susceptibility to disease and famine from the destruction of food crops intended to feed grazing livestock and humans. Noxious gas emissions cause short-term (hours – days) or extended (months – years) local air pollution events (vog) and contaminants in emissions can induce asphyxiation and respiratory problems. Testing of rain, ground, and surface waters was performed throughout the central caldera and in villages in the north to the southwest of the island. pH measurements of rainwater, under observed plume locations, found acidified deposition ranging from 2.69 – 4.64. Primary water sources for native inhabitants consisted of rain catchment systems built of a concrete/coral mixture or of fiberglass. Water in concrete/coral catchment tanks recorded weakly acidic to almost basic pH values, possibly due to the buffering capacity of the tank materials. However, water in fiberglass tanks located in areas proximal to observed plume directions had acidic pH values comparable to intra-caldera precipitation. During the study period, no obvious visual impacts were noted on inhabitants and vegetation located outside the immediate vicinity of the caldera. At this time, inhabited sections on Ambrym were spared from volcanic fumigation as regional weather patterns held the plume elevated, near the altitude of injection. However, the levels of SO₂ emissions along with high levels of acidified deposition indicate the existence of profound long-term health problems.



Traversing the parasitic cone Niri Mbwelesu of Marum (background). Image: Steven Clegg