Energy and the Geosphere
Volcanic Gases-http://volcano.oregonstate.edu/education/gases/index.html

Understanding gases dissolved in magma is critical in understanding why volcanoes erupt. Bodies of magma rise in the crust until they reach a point of neutral buoyancy. The expansion of gases brings the magma closer to the surface and drives eruptions. The interaction between the viscosity and temperature of the magma and the gas content determines if an eruption will be effusive or explosive.

Direct Sampling

The easiest, but often the most difficult, way to collect a sample is by hand, placing a container directly in the gases. This method was perfected by the late Werner Giggenbach. Difficulty arises because of the high temperatures, dangers associated with being close to vents, and the possibility of contamination of the sample by the atmosphere. Direct samples are most commonly collected in solution-filled bottles and then returned to the lab for analyses. Some of the gasses collected are: H_2S, SO_2, HCl, HF, CO_2, H_20, H_2, CH_4, O_2, CO, N_2, Ar, Ne.

Another way to measure gases released by a volcano is to collect fresh ash samples (before it rains) and pour distilled water through the ash. Then after the liquid passes through the ash it is collected. This is the leachate. The leachate is analyzed for Cl, F, SO_4, and pH. The ratio of Cl to S increases prior to eruptions.

Leachates were measured prior to the 1980 eruption at Mount St. Helens. Cl and SO_4 were measured in the field and the S/Cl ratio was observed to increase gradually from March 28 to May 18.

The S/Cl ratio increased 30 times over its initial value prior to an eruption of Asama volcano in Japan. At Fuego, in Guatemala, the S/Cl ratio increased 5 times over its initial value and the size of the change was proportional to eruption size.

Continuous direct sampling is a relatively new method to monitor gases. Results of measurements are telemetered to safe locations off the volcano. At Mount St. Helens, upward-moving fresh magma was detected 12 to 60 hours before it was extruded into the dome.

On the back of this worksheet is a data table that includes a few volcanoes, their average temperatures and concentrations of select gases. You will be categorizing this data in order to have a better understanding of the types of gases in different volcanoes as well as how plate boundaries affect the concentrations of these gases.

	Mt. St. Helens	Merapi	Erta Ale	Surtsey	Kilauea
T (°C)	802	915	1032	1125	1010
H_2O (mole %)	91.58	88.87	69.41	81.13	79.8
CO_2	6.64	7.07	17.16	9.29	3.15
CO	0.06	0.16	0.75	0.69	0.06
SO_2	0.2089	1.15	9.46	4.12	14.9
S_2	0.0039	0.08	0.59	0.25	0.309

- Convergent-plate volcanoes: Etna, Mount St. Helens, Merapi
- Divergent-plate volcanoes: Erta Ale, Surtsey
- Hot-spot volcano: Kilauea