Introduction

The site of this field study is located approximately 20 kilometers northwest of Guatemala City and approximately 2 kilometers south of San Juan Comalapa, outside the village of Chimiya. The entrance to the Long Way Home ecological park is located at N14´43.554, W90´52.812.

(Figure 1 – Map of Guatemala (yahoo.com))

The purpose of the investigation is to provide Long Way Home with information about the local and regional geology of the area. I would like to thank Matt Panietz, the director of Long Way Home, for the opportunity to live, work, and study in an exceptionally unique environment, full of history, culture and beauty.

This investigation was conducted over a period of five months, from January to the end of May. Methods included hiking various localities and collecting different rock samples. There have been no previous geologic studies in this specific area of research.

Regional Geology

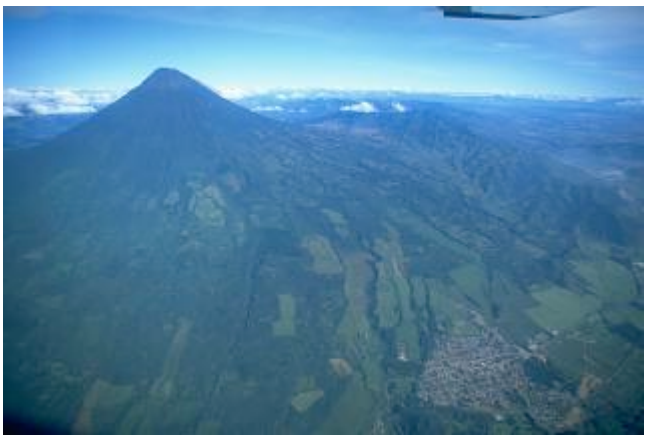
Guatemala boasts some of the world's most active volcanoes. The north-south trending range is due to the subduction of the Cocos plate beneath the Caribbean plate. These stratovolcanoes are approximately Holocene to Pleistocene (500,000 years to 3 million years) in age. The following figure shows the location of the volcanic Guatemalan range.

(Figure 2 – Location Map of Volcanics in Guatemala (usgs.gov))

Pacaya is one of Guatemala's most active volcanoes and is located approximately 30 kilometers south of the capital, Guatemala City. Its last eruption occurred in 1989 and produced a 4.5 kilometer tall eruption column of ash and basaltic lava flows were emitted in 1990 and 1991. Currently, a cluster of dacitic lava domes occupies the caldera floor (usgs.gov).

(Figure 3 – Photo of Pacaya Volcano (volcano.si.edu))

Agua is located within 5 to 10 kilometers of Antigua and Guatemala City. Agua has a height of 3,760 meters and is one of Guatemala's highest peaks. The volcano has not had a recent eruption, the last one occurring approximately 500 years ago. When the next eruption does take place, it has great potential to produce very large lahars that could possibly cause great damage to life and property to surrounding populated areas (usgs.gov).



(Figure 4 – Photo of Agua volcano (volcano.si.edu))

Fuego and Acatenango are twin volcanoes and are comprised of a string of volcanic vents. Volcanism in these two volcanoes dates back to about 200,000 years ago and has produced numerous large lahars that cover hundreds of kilometers surrounding the peaks. These two volcanoes commonly produce plumes of fine ash, lava flows, and hot pyroclastic flows (usgs.gov).

(Figure 5 – Photo of volcanoes Fuego and Acatenango (volcano.si.edu))

Atitlan consists of three large calderas that have been building and collapsing for the last 14 million years. The modern caldera was formed approximately 84,000 years ago. The first recorded eruption of Atitlan took place in 1469; it erupted again in 1717 and remained active until 1721. The last strong eruption took place 1853 and covered the sky with dark ash for almost 55 days around the caldera (usgs.gov).

(Figure 6 – Photo of caldera and volcano of Atitlan (volcano.si.edu))

Santa Maria had one of the largest eruptions of the 20th century in 1902, leaving a 1-kilometer wide crater on the southwest flank. Since that last major eruption, there has been continuous dome building accompanied by minor explosions, periodic lava extrusions, and lahar flows (usgs.gov).

(Figure 7 – Photo of Santa Maria volcano (volcano.si.edu))

Local Rock Description

The area of and surrounding San Juan Comalapa is solely comprised of pyroclastic ash fall up to 30 meters thick in most places. Within these walls of welded volcanic ash and tuff, small fragments of obsidian and long tubed pumice, also known as pumic lapilli, can be found.

The extensive blanket of ash covering the topography is due to hundreds of thousands of years of deposits from numerous sources. Comalapa is within 15 to 30 kilometers of several volcanoes, all experiencing multiple eruptions throughout their history. Volcanic ash is formed during these explosive volcanic eruptions. These occur when gases dissolved in molten rock expand and escape into the air. The force of this escaping gas shatters solid rock and blasts them into the air. While suspended in the atmosphere, the fragments solidify into volcanic rock and glass. Once in the air, wind can blow the tiny ash particles tens to thousands of kilometers away from the volcano (usgs.gov).

Obsidian is a black glassy rock which has not crystallized. It is derived from high silica lava that has cooled too quickly for any of its atoms or ion to group into regular structures of minerals. Obsidian can never be old in the geologic sense and can

only be found where volcanic activity has taken place in recent geologic time. With time, obsidian tends to slowly crystallize into a fine grained rock or to regroup into analcime by a process of taking in moisture and/or trading elements. Freshly broken obsidian is black and glassy and is translucent in thin sections.

(Figure 8 – Photo of Obsidian (usgs.gov))

Pumice lapilli is a light porous volcanic rock consisting of a network of gas bubbles frozen amidst volcanic glass and minerals. Pumice can form from dacite, andesite, basalt, and rhyolite. It is usually very high in viscosity and contains globules derived from vent walls. These globules or lithic fragments are accumulated at the base of the flow and decrease upward; while the pumice is more abundant upward and decrease toward the bottom. The pumice lapilli is spread laterally under the load, indicating it came from an exceptionally hot and thick deposit. Oxidation of the pumice causes streaks of red, yellow, and brown.

(Figure 9 – Photo of pumice (usgs.gov))

Environmental Hazards

In 1976 a major earthquake hit Guatemala, killing more than 23,000 people throughout the country. San Juan Comalapa, a town of 20,000 inhabitants, was literally levelled and an estimated third of the population was killed. Several faults were found approximately a kilometer southeast of the town. These parallel right lateral slip faults have a trend of N 80° W. No slicken lines were observed due to high erodibility of the volcanic ash. This area experiences many small tremors and another devastating earthquake is due. The town's structures are primarily built of cinder block and have a very low tolerance to any type of violent shaking caused by earth movements.

(Figure 10 – Photo of the church in Comalapa alter the 1976 earthquake

In early October of 2005, Hurricane Stan hit Guatemala causing death and destruction throughout the country. San Juan Comalapa is located above 7,500 ft. with steep slopes surrounding the town. The area is extremely prone to landslides and flooding. The volcanic ash is very highly erodable and prone to give way with enough saturation. This could prove to be a major hazard for this years hurricane season, especially since farmers outside of the town have deforested the area for agriculture, thus, decreasing stability.

During a week of late March of 2006, the organization Engineers without Borders, made a visit to the Long Way Home ecological park. Among other duties performed, a water quality assessment was conducted. It was found that local water supplies tested positive for ecoli and pesticides such as Antrazine and Simazine. Nitrates in the water were found to be around 5 to 10 parts per million. Water quality is a serious health issue in these parts and results in many sicknesses in the local population.

Work Cited

Websites:

http://vulcan.wr.usgs.gov/Volcanoes/Guatemala/framework.html

http://www.volcano.si.edu/reports/usgs/

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