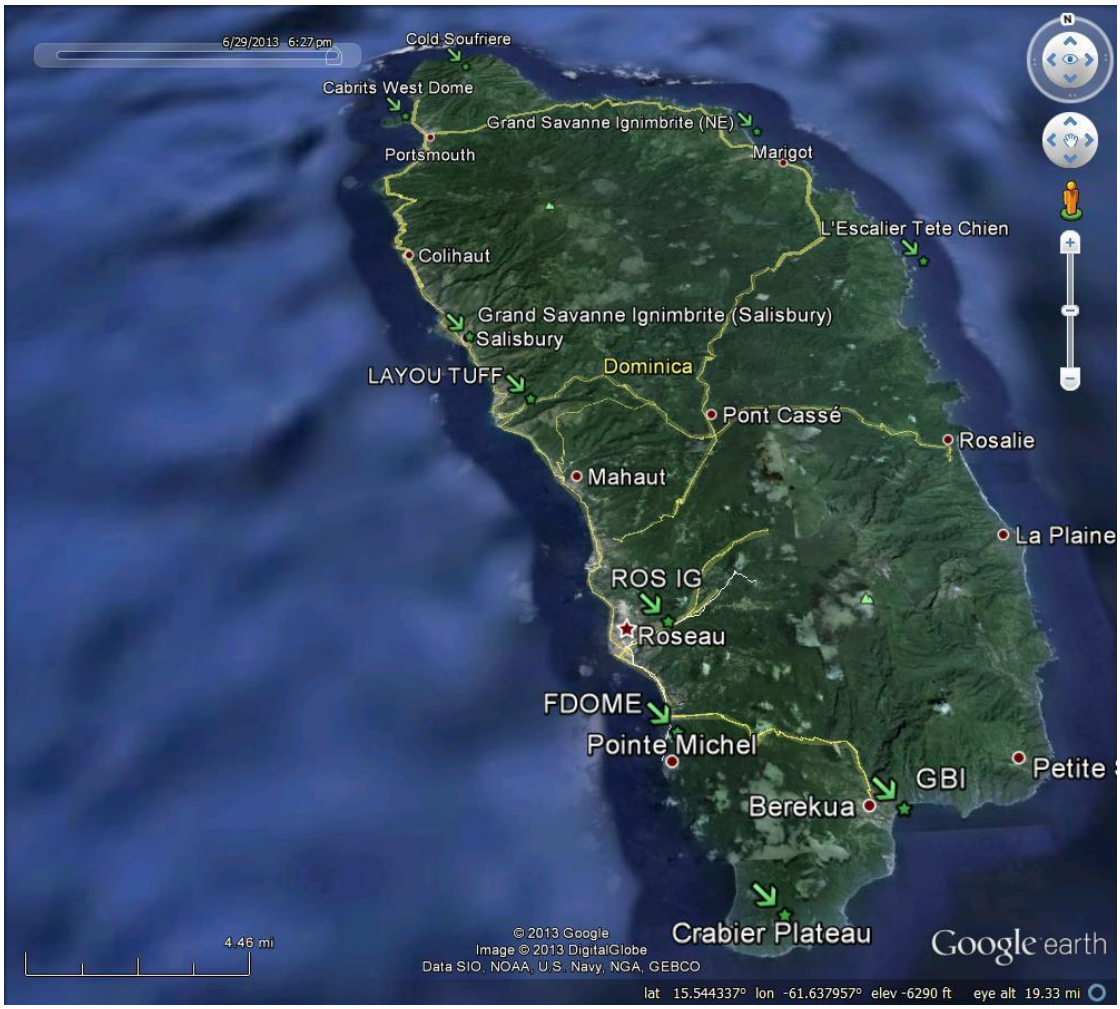

Dominica Field Trip Summary

Summer 2013

Ophelia George

7/17/2013

Short Description, images and GPS locations of samples and deposits seen during this field trip

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Summary of Dominica Geology and research to date

This field trip served as a reconnaissance mission to establish noteworthy volcanic deposits which will be useful in characterizing the hazard potential of volcanic vents located on the island of Dominica in the East Central Caribbean. The island occupies a unique geodynamic setting in the arc which is manifested in the abundance of volcanism displayed on island in the past. Dominica is a relatively young, (Late Miocene) age volcanic island formed following an approximately 30 million year hiatus in activity for the northern half of the arc. This hiatus in activity was thought to be driven by subduction of a buoyant ridge segment which resulted in a lock trench zone (Wadge 1994). Subsequent subduction following this lock-up resulted in a shift in the arc and a resumption of activity in the northern portion. Activity in the north tends to be more vigorous and has a slightly shallower dipping Wadati-Benioff zone (50-60°) which extends to a depth of about 210 km.

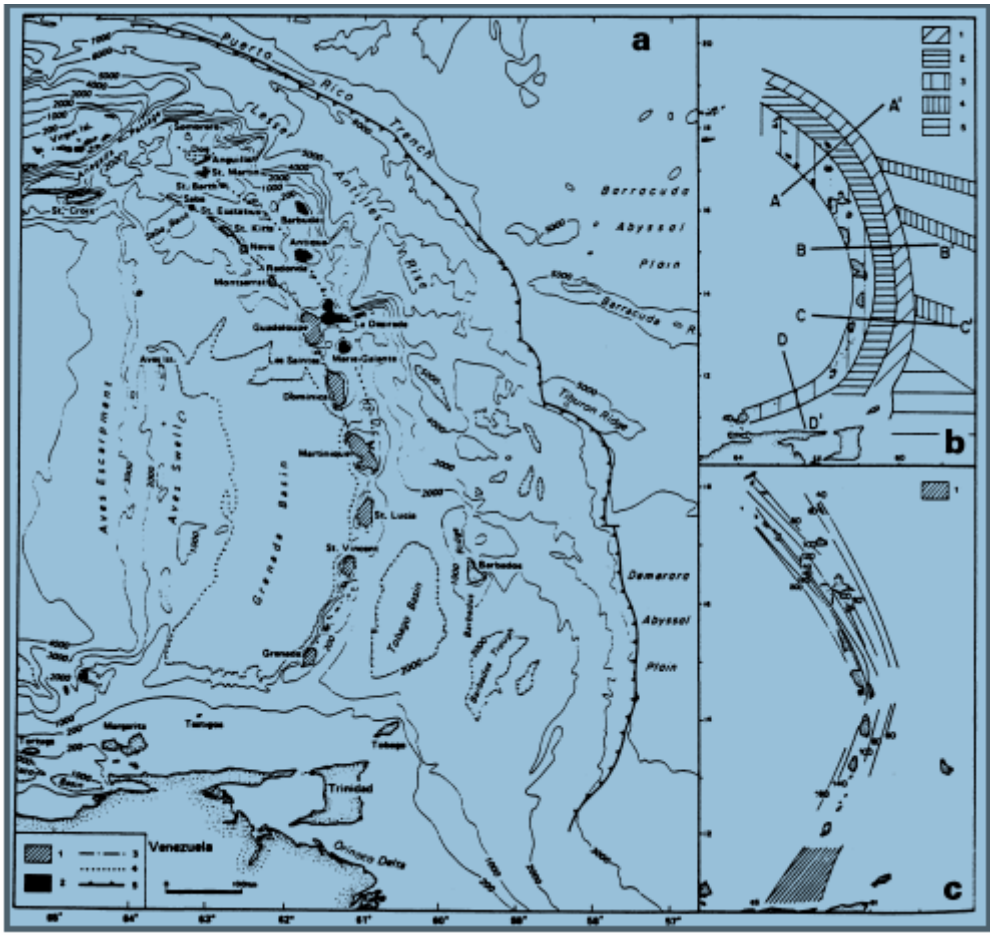

Figure 1 – Figure 9.1 from Wadge (1994). Map of the Lesser Antilles region, (a) Bathymetric map. l=Volcanic Caribbees; 2=Limestone Caribbees; 3=axis of the inner arc; 4=axis of the outer arc; 5=deformation front. Isobaths in m. (b) Schematic crustal structure of the Lesser Antilles arc. l=outer forearc crust; 2=inner forearc crust; 3=arc massif; 4=oceanic basement ridges; 5=late Jurassic –early Cretaceous Atlantic crust. AA', BB', CC', DD'=lines of sections shown in Figure 9.2. (c) Isobaths (in km) of the Benioff zone beneath the arc (after Wadge and Shepherd19). The diagonal shading shows the vertical part of the southern zone beneath the Venezuelan continental shelf. (After Maury *et al*.9).

This shift in activity must have been accompanied by a significant shift in arc dynamics as manifested by the heightened activity seen on Dominica. The island, which is located just

north of the locus of the formerly locked plate has nine potentially active volcanic centers as opposed to one or two as seen on the other islands of the Caribbean. In addition, while volcanism tends to be solely focused in one location on the other islands of the Caribbean, Older Pleistocene deposits on Dominica show that activity spanned the entire island for 100 of thousands to millions of years (Lindsay, Smith, et al. 2005). Increased activity may be due to large volumes of melt beneath the island caused by enhanced melting of the subducting slab or increased volatile exsolution from the subducting slab and sediments. Enhanced exsolution of volatiles in this area may be supported by evidence of relatively high water content of eruptive magmas in the south of the island (3-6 wt %) ((Gurenko 2005), (Halama, et al. 2006)). It is also manifested in the explosive nature of past volcanic events - the largest volcanic eruption of the Lesser Antilles in the last 100,000 years originated on Dominica producing 30 km^3 of tephra (these volumes are likely underestimated) (Carey and Sigurdsson 1980). Figure 2 shows a relief map of the island as well as the location of some of the potentially active volcanic centers.

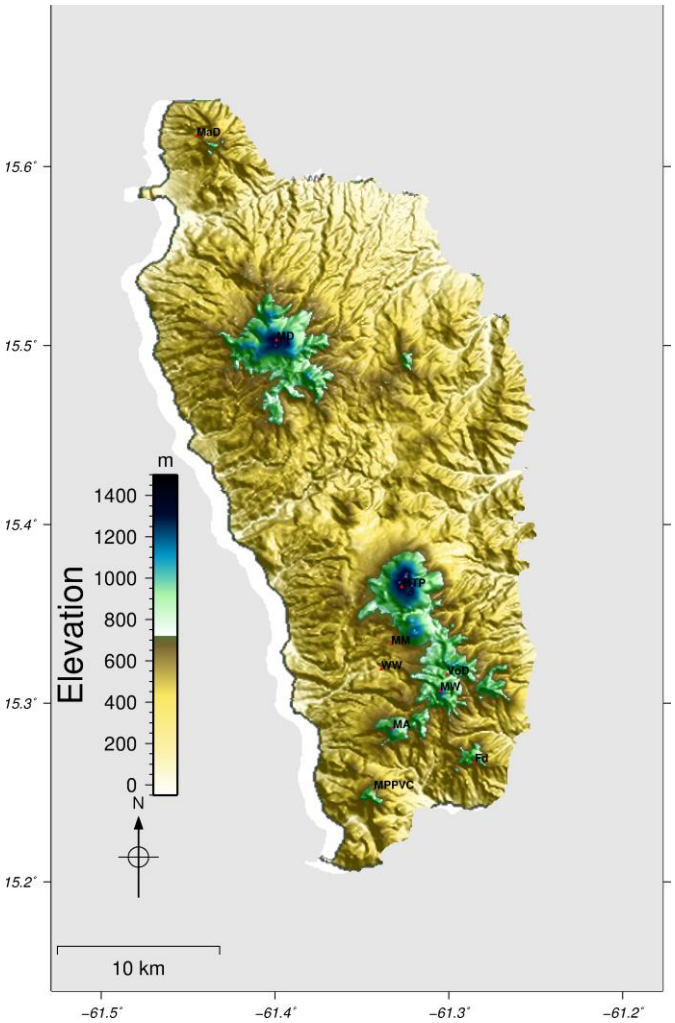

Figure 2 - Relief map of Dominica showing the locations of potentially active volcanic centers

As can be seen from the relief map in figure 2, the island is comprised largely of volcanic centers many of which are considered to be potentially active. Population centers on island are

situated either on the flanks of these volcanoes, on deposits from previous volcanic eruptions or in small hamlets which hug the narrow strips of coastline at the base of these volcanoes. While historic eruptions have not taken place on island, its recorded history is marked by a few minor phreatic explosions as well as numerous episodes of seismic unrest. Geochronological dating techniques place the last eruption on the island to at ~ 500 years B.P. These factors as well as the continuous geothermal activity on island when coupled with the youthful appearance of many of the volcanic vents indicate that future volcanic activity on island is likely. Figure 3 shows the pattern of seismicity over that last 50 yrs – many of the events are located near volcanic vents in the south of the island. The proposed research project on this island will use double difference relocation techniques to improve event locations which should lead to more accurate assessment of activity. The table below shows a list of ages from various volcanic centers around the island as determined by previous workers. During this field trip, samples were collected primarily from the younger, less weathered deposits.

Table 1 List of ages for the various deposits dated on island. This list was compiled by Lindsay et al. (2005) and was originally published in the Dominica chapter of the Volcanic Hazard Atlas of the Lesser Antilles.

Ages of most recent deposits						
Age	Error	Complex	Sample Location	Method	Material	Ref
2900	370	VoD	Ph exp crater	C14	Wood	4
3750	100	VoD	Ph exp crater	C14	Wood	4
4050	80	VoD	River Blanc	C14	Wood in lahar	4
450	90	PPVC	NE foot Patates	C14	B and A	13
685	55	PPVC	Nr Soufriere school	C14	B and A	10
1100	100	PPVC	Nr fumaroles	C14	NA	4
1560	40	PPVC	Turn off to SS	C14	Ignimbrite	10
2380	75	PPVC	Scotts Head	C14	PR surge	9
6600	50	PPVC	Grand Bay quarry	C14	Andesite PF	9
6670	60	PPVC	Grand Bay quarry	C14	Andesite PF	7
6825	75	PPVC	Grand Bay quarry	C14	Andesite PF	10
6650	50	PPVC	Mt Lofty rd	C14	B and A	10
35800	260	PPVC	Pte Guignard Estate rd	C14	Airfall pumice	10
240000	70000	PPVC	Scotts Head	K-Ar	Andesite dike	2
1100000	80000	PPVC	Sibouli	K-Ar	Andesite lava	1
47330		PPVC	La Falaise quarry	C14	B and A	10
26400	2500	MA	Near Soufriere	C14	Scoria fall?	4
28450	1500	MA	Soufriere rd, N side of depression	C14	Scoria fall?	8
430000		MA	Giraudel	K-Ar	B and A	4
1020	40	Micotrin	Near tram line	C14	Pumaceous PF	11
1025	45	Micotrin	Valley of Desolation trail	C14	Pumaceous PF	11
1050	70	Micotrin	Start of Valley of Desolation trail	C14	Pumaceous PF	4
1160	45	Micotrin	Laudat	C14	B and A	11
25370	120	Micotrin	Bath Estate	C14	B and A	11
26380	190	Micotrin	Micotrin ring road	C14	Pumaceous PF	11
26500	900	Micotrin	Laudat	C14	B and A	6

26400	1500	R Tuff	Confluence Douce and R River	C14	Pumaceous PF	4
27600	1130	R Tuff	Du Mas Estate	C14	Pumaceous PF	4
28400	900	R Tuff	Goodwill quarry	C14	Ignimbrite	16
29000	4000	R Tuff	Goodwill quarry	C14	Airfall pumice	15
33200		R Tuff	Goodwill	C14	Ignimbrite	15
34000		R Tuff	Goodwill quarry	C14	Ignimbrite	16
35000	2200	R Tuff	Goodwill	C14	Airfall pumice	6
46000	4500	R Tuff	Goodwill quarry	C14	Ignimbrite	16
19500	500	GF-RU	En bas Petit Fond	C14	Pumaceous PF	12
27600	600	GF-RU	Grand Fond	C14	Ignimbrite	15
31000	4000	GF-RU	Tete Grand Fond	C14	Ignimbrite	15
34600	1500	GF-RU	Rosalie	C14	Ignimbrite	12
30270	200	WHQU	Wall house quarry	C14	Ignimbrite	7
38610	350	WHQU	Wall house quarry	C14	Pumaceous PF	10
27200		GBI	Near Stowe	C14	Distal facies	14
36800		GBI	Fond St Jean	C14	Distal facies	14
38890	600	GBI	Fond St Jean	C14	Distal facies	7
1270	75	MW	River Padu Near Hartington estate	C14	wood in B A	4
1350	75	MW	River Blanc	C14	wood in lahar	4
10290	60	WM	Perdu temps trail; divide to river jack	C14	Pumaceous PF	11
460000		MW	Upper part of Trois Pitons River	C14	Andesite lava	4
17240	720	MTP	Belles Bridge	C14	B and A	6
25310	230	MTP	Belles/Pont Casse	C14	B and A	13
40000		MTP	Layou	C14	Pumaceous PF	6
10320	40	GSH	Near mouth of Pt Mulatre River	C14	B and A	7
11000	85	GSH	Corossol	C14	Lateral blast	11
800000	400000	GSH	Eastern foot of Dome	K-Ar	B and A	6
22200		MD	Grand Savanne	C14	Ignimbrite	5
40000		MD	Gabriel	C14	Surge deposit	6
46620		MD	Point Ronde	C14	B and A	7
700000	500000	MD	Summit Dome	K-Ar	Andesite lava	6
720000	110000	MD	Pointe La Soie	K-Ar	B and A	1
46740		MaD	Near Enbas on east coast	C14	B and A	7

Age of older Miocene - Pleistocene deposits ages are given in Ma

Age (MA)	Error	Rock type	Sample Location			Ref
5.22	0.26	basalt	Near Rosalie			1
6.19	0.93	basalt	M Pagua river			2
6.7	0.5	basalt	Good Hope			2
6.79	1.02	basalt	Good Hope			2
6.92	0.52	basalt	M Pagua River			1
12.94	1.94	sill	NE of Belles			1

2.76	0.21	dike	CB River			2
3.06	0.23	dike	San Sauveur			2
3.35	0.17	dike	Near Belles			2
1.77	0.7	NA	NB Boeri river			3
1.92	0	Andesite	CE, Cochrane			4
2.39	0.12	Dacite	Cochrane			2
2.51	0.13	Andesite	Morne Cabrits			2
2.53	0.13	Andesite	Near Warner			2
2.82	0	Andesite	River Claire			4
2.83	0.14	SA Andesite	Check Hall			2
2.85	0.14	Pillow	Massacre			2
3	0.15	NA	Cochrane			2
3.14	0.16	congl	Ravine Bernard			2
3.14	0.16	SA basalt	LB Boeri river			2
3.15	0.16	Andesite	RR, Fond Cani			2
2.5	0.38	basalt	L Pagua River			2
2.58	0.38	basalt	L Pagua River			2
2.66	0.4	basalt	L Pagua River			2
2.21	0.11	Andesite	Nr Morne Raquet			1
2.24	0.34	Dacite	Morne Espaniol			2
2.7	0.2	SA basalt	Marigot Bay			2
3.41	0.17	basalt	Near Hansen			2
3.72	0.28	Andesite	Near Colihaut			2
1.12	0.07	Andesite	U Savanne River			3
2.23	0.33	basalt	Near Stowe			2
2.27	0.17	basalt	Nr Fd ST Jean			2
1.77	0.13	Andesite	Bioche			2
1.68	0.25	Dacite	West Cabrit			2
1.72	0.13	B & A	Hermitage Bay			2
2.01	0.3	Andesite	NA			1

Field Work Summary – 6/20/2013 – 7/2/2013

Arrival in Dominica – Day 6/20/2013

Trip began with a four hour drive to Miami from Tampa on June 19th. On June 20th, I flew from Miami to San Juan and then from San Juan to Dominica. I arrived at Melville Hall Airport in Marigot around 2 pm local time. After clearing customs, I took a shared taxi from the airport to Pointe Michel, where I stayed on Island when I wasn't staying in Portsmouth (June 24-28th) or in Pont Casse (July 1st).

Day 2 – Getting set up 6/21/2013

Secured transportation for trips to Salisbury, Scott's Head and Portsmouth from 6/22-6/28.

Day 3 – Salisbury 6/22/2013

Primary feature to see at this location is the Grand Savanne ignimbrite which outcrops at a number of locations around the island. Also outcropping here are pumice and reworked ashfall deposits. These may or may not be part of the same eruptive episode – not easily determined since outcrop from these features are not generally collocated.

Stop 1 - Grand Savanne Ignimbrite

GPS location: 15.435592°, -61.439158°

This deposit is thought to have originated from an explosive episode of Morne Diablotins about 30,000 years ago. This deposit is a massive deposit with 3 to 4 major layers visible

- Block and ash flow deposit – This layer is comprised of a large angular lithic fragments supported by a matrix of ash and much smaller pumice fragments
- Coignimbrite cloud? – a thin layer of altered ash separates the block and ash flow layer from the overlying ignimbrite deposit.
- Lahar deposit – in some areas, the block and ash flow deposit is overlain by a small (~ 1 m thick) lahar deposit
- Ignimbrite deposit – in all cases, the deposit is topped by a welded – partially welded ignimbrite deposit which contains a significant number of fiames.

Figure 3 - View of Grand Savanne Ignimbrite deposit at Salisbury with a close up of the block and ash flow component on the right

Figure 4 - Broken off block from the ignimbrite layer showing some flattened pumice (iguana for scale)

Stop 2 - Pumice Fall Deposit

In at least one location in this area, pumice fall deposits measured ~ 2 m thick and contained mainly sub rounded to subangular fragments and little fine material – not pictured

Stop 3 - Reworked ash deposit

Another prominent feature here is reworked ash deposits which form layers similar to a mudstone/shale deposit – not pictured

Figure 5 - Likely pumice fall deposit

Figure 6 – Local friend, Jodie Shillingford and I observing a lahar deposit beneath the larger ignimbrite unit of the Grand Savanne Ignimbrite

Day 4 – Southern Domes – 6/23/2013

Stop 1 - Pointe Michel Quarry and La Falaise dome

Sample location: **15.267761°, -61.375860°**

La Falaise dome is part of the system volcanic vents thought to have been emplaced in the Soufriere depression following the collapse of the ancestral Morne Plat Pays stratovolcano ~ 40,000 yrs ago. This site is likely at the base of this dome and is made up of highly fractured, crystal rich andesitic blocks (large amphiboles are present in this sample which is not typical for deposits on this island). Rocks are fairly weathered and covered with vegetation for the most part. A rock sample was collected (FDome) at GPS location: 15° 16.060' N, 61° 22.551' W. Next to this dome is an active ash quarry which was inaccessible due to safety regulations.

Figure 7 - Andesitic rocks making up the base of the La Falaise dome

Figure 8 - Sample of La Falaise dome andesites showing an abundance of amphiboles and weathered feldspars

Figure 9 Excavated ashfall deposit at Pointe Mitchel Quarry

Stop 2 - Scott's Head to Soufriere hike

Scott's head

There is a lot of debate about this feature – in some schools of thought it represents an in situ lava dome while others classify it as a large block emplaced during a block and ash flow (perhaps the one associated with the generation of the Soufriere depression). This deposit is composed largely of weathered igneous rocks of similar composition to that seen in the La Falaise Dome. If associated with the formation of the Soufriere Depression, this feature could be as old as 40,000 yrs old otherwise, it is considerably younger ((Lindsay, et al. 2003), (Le Friant, et al. 2002).

Figure 10 (A) Looking out at the Soufriere depression from atop Scotts Head (Morne Crabier (Cr) at the southern end of the depression and Morne Patates (P) to the north. (B) Viewing Scotts Head from the village of Soufriere. (C) Looking down at the Scotts Head from the rim of the Soufriere Depression

Crabier Plateau and Soufriere Depression

15.214705°, -61.353150°

The Soufriere depression, a horse shoe shaped depression, is associated with major sector collapses of the ancestral Morne Patates. This event could have occurred in three major stages beginning ~ 100,000 yrs ago. The second phase of this collapse event is thought to have resulted in the deposition of the Grand Bay Ignimbrite ~40,000 yrs ago. According to Lindsay et al (2005) more recently (within the last ~ 7000 yrs), collapse activity in this region resulted in the formation of the large number of domes which are prevalent in the area. These are largely basaltic-andesite to andesitic domes with relatively low amphibole content.

Figure 11. Looking out at the northeastern rim of the Soufriere Depression

The Crabier plateau is a relatively flat area along the rim of the Soufriere Depression. Here, large andesitic boulders outcrop in a number of locations within this field.

Figure 12. Crabier Plateau with Morne Rouge in the background. A large number of andesitic blocks were seen here.

Soufriere Sulfur Springs

This is one of the many sites where the geothermal state of the island is physically expressed. Unlike the other geothermal spots on island, most of the hot water pools and their sources have been thoroughly developed to appeal to locals and tourists alike. Water temperatures tend to be relatively stable, ranging from 85 to 98°C though colder temperatures (34°C) have been measured in the lower springs (Joseph and Lindsay 2002 and Joseph and Robertson2003).

Figure 13 Photo of a large hot spring taken from Google Earth.

Day 5 – Pointe Mitchel roadside deposits – 6/24/2013

Due to its position within/near the Soufriere Depression, the Pointe Mitchel area shows a lot of evidence for volcanic/tectonic activity. Road cut deposits between Pointe Mitchel and Champagne (an underwater fumarole) show evidence of past block and ash flow activity. Block and ash flow deposits tend to have relatively high ash content with roughly equal proportions of lithics and juvenile material. Chemistry is similar to what was seen in the Soufriere depression and the La Falaise dome a few meters to the north.

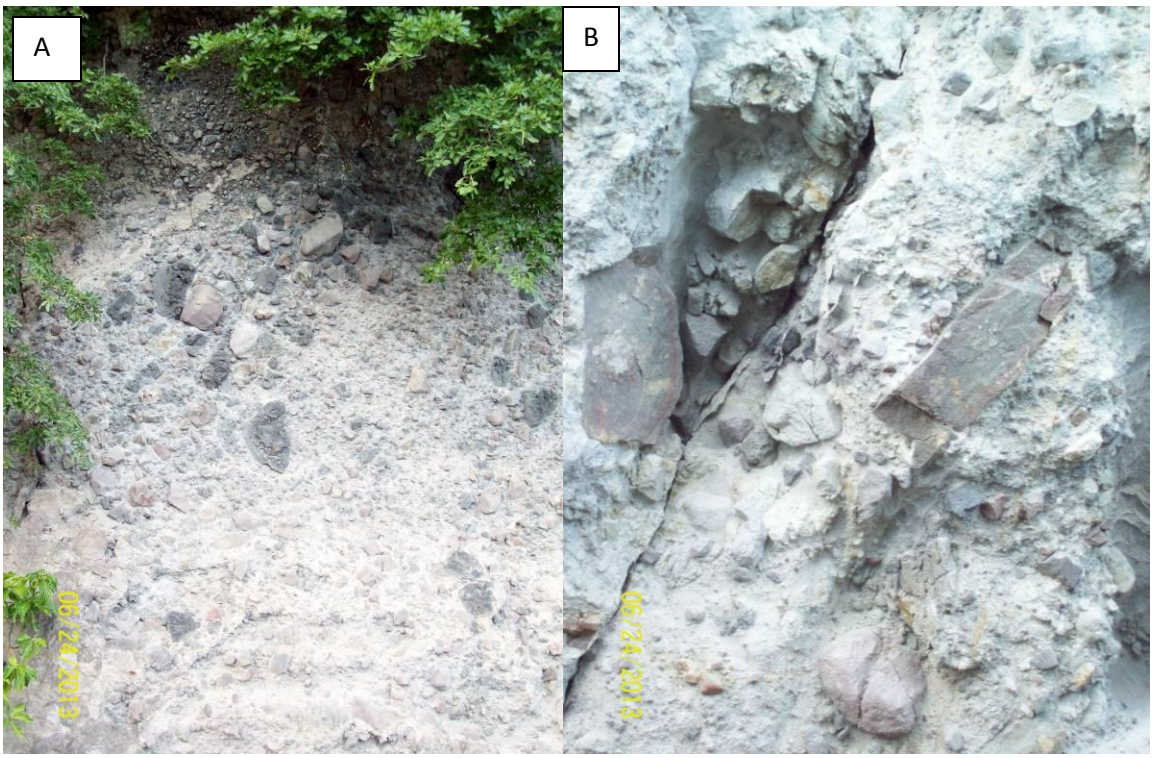

Figure 14 A - block and ash flow showing a mixture of ash, lithics and juvenile material. The "top" of this deposit is largely reworked by the vegetation. B - Chill margins on juvenile fragments in the block and ash flow deposit.

There are also possibly faults in the outcrop (right-lateral strike slip. In some areas, it is hard the deposit appears to be a breccia rather than a block and ash flow.

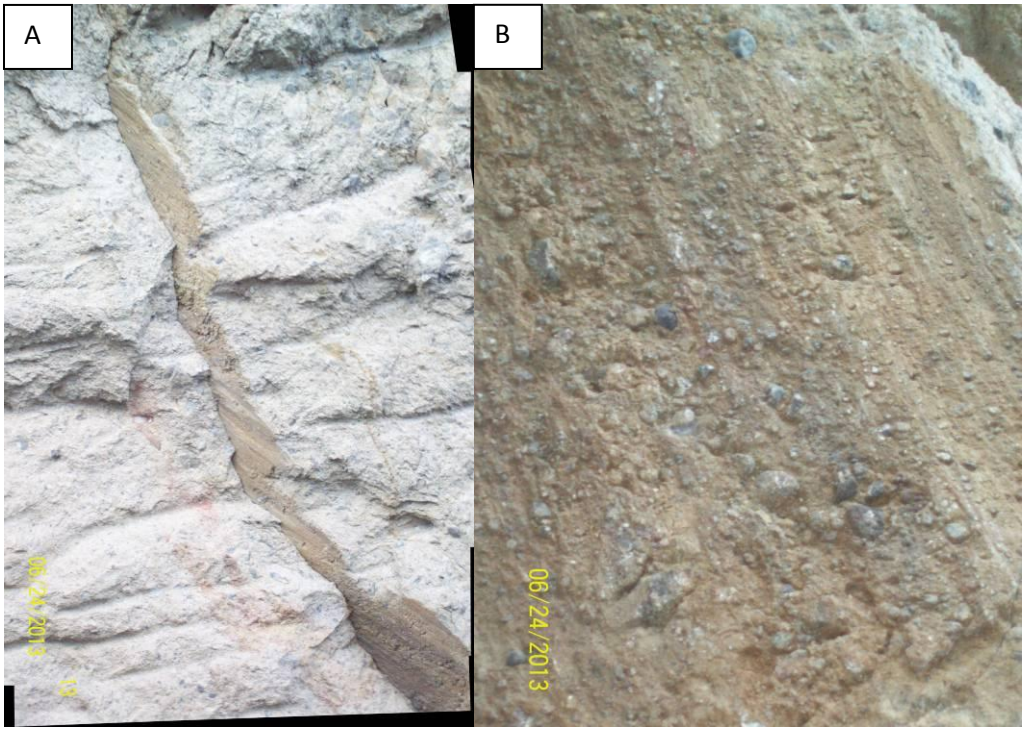

Figure 15 A - Possible fault in exposed in roadside deposit between Pointe Mitchel and Champagne. B- Close up of "faulted" surface.

Drive to North

Day 6 – Exploring deposits in the North – 6/25/2013

We spent most of this day looking at deposits/features near the Portsmouth area.

Stop 1 - Cabrits domes/meeting with Lennox Honychurch

15.585433°, -61.470302°

These twin "domes" are highly crystalline andesite spines that were injected off the coast of the mainland. There was initially a lake between these domes and the mainland which eventually silted over to form the swamp which can be seen from West Cabrits. The current age of these domes in under debate; the last geochronological work done on them indicate an age of about 0.4 million though their state of erosion may indicate a considerably younger age (~ 30 kyr).

Figure 16 A - Cabrits Domes as viewed from the town of Portsmouth. B. View of the swamp and northernmost domes of

Prior to hiking up to the top of West Cabrits, we spoke with the local historian about the role of volcanism in native folklore. To the natives the volcanic chain represented something vastly different from what they left behind on mainland South America. As such, volcanism and volcanic features quickly become incorporated in their cosmology. For instance, one creation story states that the basaltic dike, L'Escalier Tete Chien, is a frozen path of snake god who climbed out of the ocean to form the island and now resides in mountain caves. Three-pointer volcanoes, called zemis, have been excavated from a number of sites and are used to represent the spirit that gave fertility to the land.

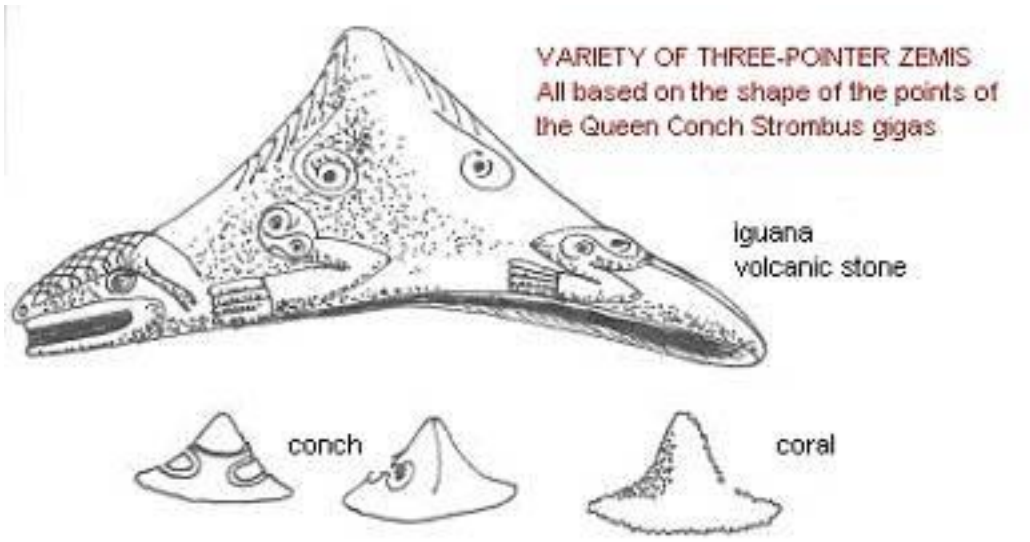

Figure 17 Native folk art depicting volcano-nature connection. Photo courtesy of http://www.lennoxhonychurch.com

Stop 2 – Roadside outcrop of block and ashflow deposit

Most of the deposits in the area are related to past activity of Morne Aux Diables and Morne Diablotins to its south. Stop 2 was at a roadside outcrop of a large block and ashflow which contained a fair amount of dome material. This flow likely traveled as much as 4 kilometers from its source and is topped by a more pumaceous deposit.

Figure 18 Block and Ashflow deposit containing a fair amount of dome material. Photo by Mandela Christian (ODM)

Stop 3 – Cross bedded layered ash deposit

This layered ash deposit is over 2 meters thick and is topped by a more pumaceous deposit. It shows evidence of crossbedding and was likely deposited in a wet environment such as a lake. ~ Grapefruit-sized blocks are suspended at various locations within this deposit. It is topped by a pumaceous deposit. A pumice sample was collected from the upper deposit.

Figure 19 Ash flow/fall deposit near the village of Penville, Dominica. Deposit shows crossbedding/layering, is topped by a more pumaceous deposit and contains larger blocks held in suspension. Inset – zoomed in view of ash deposit. Photos courtesy of Mandela Christian.

Figure 20 Ash fall/pumice deposit further down the valley from the deposit seen in figure 19. This may be part of the same event by deposited in a slightly different environment. Photo courtesy of Mandela Christian

Stop 4 – Cold Soufriere

15.619222°, -61.439597°

Unlike the other geothermal springs on the island, the springs in this area tend to be mostly cold to the touch with very few reaching temperatures above 32 °C. Many of the pools in here are surrounded by sulfur deposits and the scent of H_2S is very prevalent. Most ponds are bubbling rapidly and are yellow-grey in color. One hypothesis for the lower temperatures here is that the gases travel a fairly convoluted path from the source thus giving them sufficient time for cooling.

Figure 21 Sulfur springs at the Cold Soufrieres in Penville, Dominica. Inset - A zoomed in view of one of the bubbling ponds. Photos courtesy of Mandela Christian.

Figure 22 Hydrothermally altered block in the Cold Soufrieres. Photos courtesy Mandela Christian

Stop 5 – Pumice Fall deposit

Figure 23 Highly altered pumice fall deposit (~10 m thick) near Penville. Deposit contains relatively small, angular pumice fragments. Age estimated at ~ 30 kyr

Day 7 – Central and southern deposits – 6/26/2013

Stop 1 – Grand Savanne ignimbrite (Salisbury)

I revisited this site with Dr. Watts since he was not aware of an outcrop of this ignimbrite in this location. In exploring with Dr. Watts we noticed the lahar deposit which I had not noticed on my previous visit.

Stop 2 – Meet and greet with ODM manager

Stop 3 – Grandbay Ignimbrite

15.241011°, -61.312080°

This large ignimbrite deposit outcrops at various locations in the south of the island. This deposit is thought to be associated with an eruption ~ 40 kyr ago and may be a consequence of the sector collapse which formed the Soufriere depression. The outcrop at this site is poorly sorted, containing a variable mixture of ash, angular pumice and dome fragments of various sizes. The rock chemistry here is very similar to that observed at other southern domes but has lower amphibole content. The deposit stands 10s of meters above the base.

Figure 24 The Grandbay Ignimbrite - an ~40 kyr volcanic deposit in the south of the island. Inset - Dr. Watts and Mandela for scale.

Figure 25 Close up view of the ignimbrite showing the pumice, dome and ash fragments that make it up.

Stop 4 – Soufriere depression (Tete-Morne lookout point)

Figure 26 View of the village of Gallion from the Western rim of the Soufriere Depression

Stop 5 – Summit La Sociere (former Campaign GPS location)

La Sociere is one of the many lava domes thought to have been emplaced in response to the formation of the Soufriere Depression. This site is a former campaign GPS location used by Glen Matioli and UWI in the past but which is now very overgrown.

Figure 27 View of Scotts Head from the summit of La Sociere.

Day 8 – Northeastern Deposit – 6/27/2013

Stop 1 – NE exposure of the Grand Savanne Ignimbrite

15.560480°, -61.297221°

This outcrop is located on the north eastern coast of the island near the village of Marigot (near the international airport). The entire outcrop is 10s of meters tall and is comprised of two main layers – a coarse pumice flow with very little fine material topped by a more ash rich deposit which contains a mixture of pumice and dome rock fragments. Pumice blocks in the lower unit tend to be subrounded to angular, are roughly cantaloupe-sized and fairly weathered. This unit is ~ 1.5 meters thick and grades upward to approximately pebble-sized fragments and higher ash content. This finer grading forms the base atop which the ignimbrite sits but is not present at all locations in this outcrop.

The ignimbrite unit is poorly welded, dominantly ash rich but contains a fair amount of pumice and dome rock fragments. It lies unconformably atop the pumice flow layer and like it, this unit is fairly weathered so fresh samples were unavailable.

Figure 28 Looking down at the Atlantic Ocean from atop the Grand Savanne Ignimbrite. This exposure stands 10s of meters above the coast.

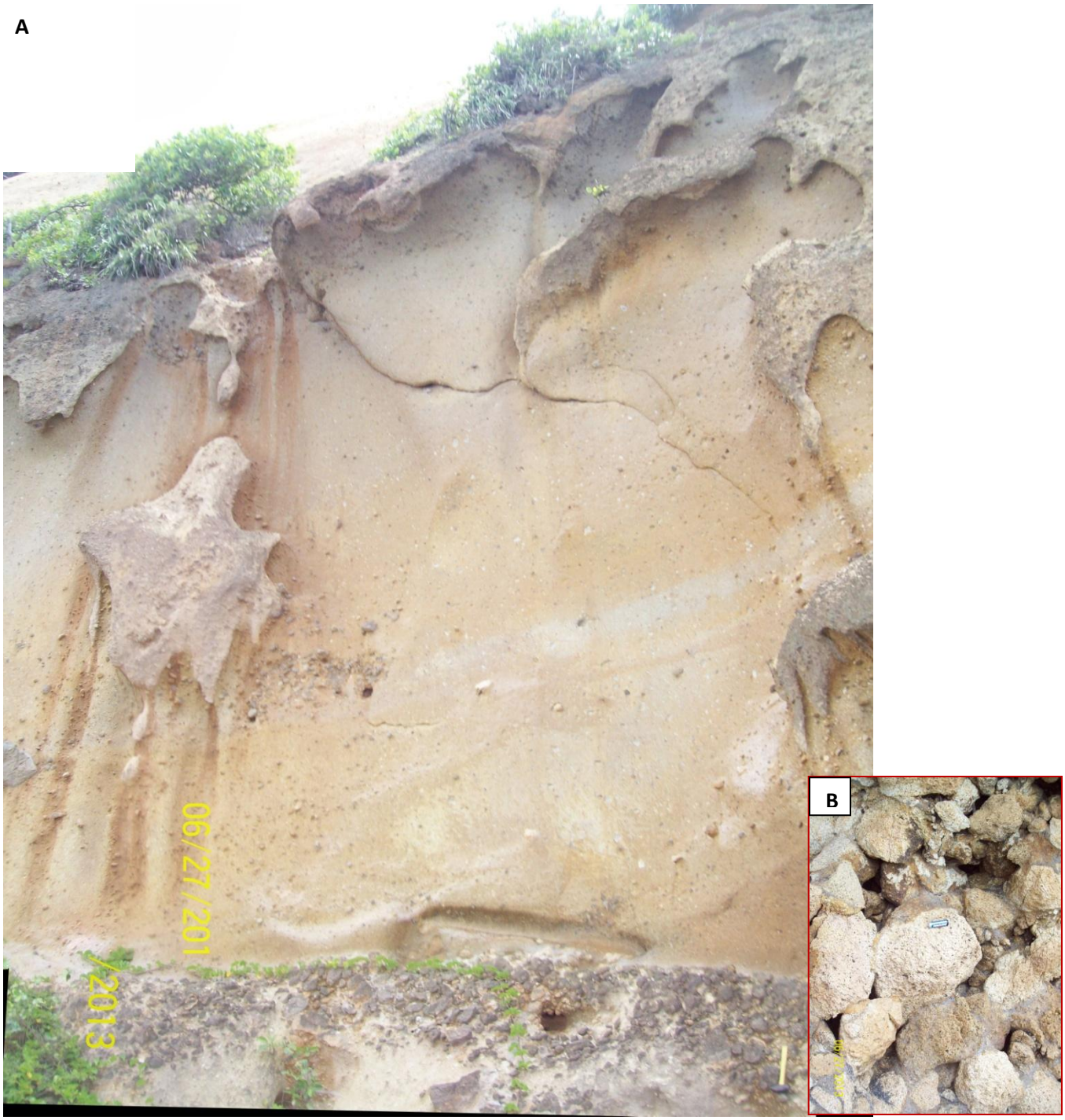

Figure 29 A - The northeastern exposure of the Grand Savanne Ignimbrite showing the two main units (a coarse pumice flow topped by an ignimbrite layer). B- Close up view of pumice flow unit (AA battery for scale).

Figure 30 Examining the ignimbrite layer of the Grand Savanne Ignimbrite. Inset gives a close up view of the different layers making up this deposit.

Stop 2 – Penville GPS Station

Figure 31 This is a permanent GPS station maintained by the University of the West Indies. We visited this site to address data transmission issues likely due to vegetation overgrowth.

Day 9 – Return to Town – 6/28/2013

Layou Tuff

15.401134°, -61.415500°

This is a large ignimbrite deposit located near the capital Roseau. There is no exact age on this deposit so it is uncertain if it is associated with the Roseau Ignimbrite deposit. The rock chemistry here is similar to that seen on other parts of the island. Samples are relatively fresh.

Figure 32 The Layou ignimbrite erupted ~ 30 kyr ago from one of the volcanoes up the valley (Morne Watt or Morne Micotrin). Inset - close up view of the deposit

Figure 33 Closer view of the deposit - the main component of this deposit is angular pumice fragments in a various range of sizes. Smaller components = ash and dome rock fragments. Inset – close up of andesitic pumice which makes up the main component of this deposit.

Day 10 – Bellevue Chopin to Wotten Waven – 6/29/2013

This ~ 7 mile hike goes through the interior of the country so is highly vegetated. I include here only a few photos of some of the volcanic features in this area.

Morne Anglais

This is one of the prominent peaks in the south central of the island which has been associated with a few seismic swarms in the recent past. Unfortunately, the summit of this volcano was mostly in the clouds for most of this hike.

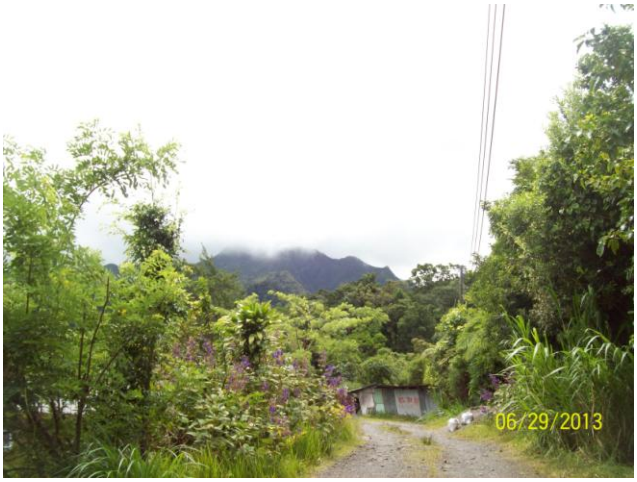

Figure 34 View of Morne Anglais from the village of Giraudel on a Cloudy day

Figure 35 Clear view of Morne Anglais. Google Earth photo by Geoffrie Kramer

Wotten Waven Sulfur Springs*

This is one of the many geothermally active sites on the island which contains several vigorously bubbling sulfur containing ponds. I did not visit this site on this trip but the scent of H_2S was very strong even from along the track. A portion of this area is a well developed tourist destination.

Figure 36 Bubbling sulfur spring image taken from Google Earth.

Roseau ignimbrite?

Figure 37 This ignimbrite outcrops just above the village of Bath Estate and may be part of the Roseau tuff deposit.

Figure 38 Two of the lava domes which form part of the Plat Pays Volcanic Complex in the Soufriere Depression.

Day 11 – Rest day/Roseau Tuff - 6/30/2013

Roadside deposit

15.304494°, -61.374058°

Figure 39 Roseau Ignimbrite outcrop at the base of Goodwill. Inset - close up view of the ignimbrite. This deposit has a high proportion of angular pumice fragments as well as ash.

Day 12 – Laudat to Pont Casse (weathered volcanic deposits) - 7/1/2013

This hike goes crosses the central portion of the island through some of the most geothermally active areas on island into older/ancestral volcanic deposits. This covers a large portion of the Wotten Waven depression - the eruption of the Roseau Ignimbrite is thought to have originated from one of the volcanoes in this valley (Morne Micotrin or Wotten Waven).

Figure 40 View of Morne Micotrin from the village of Laudat

Valley of Desolation*

This is a large geothermal area found en route to the boiling lake. Here, there are a large number of bubbling springs, rocks are highly altered and sulfur deposits are abundant. Water temperatures measured here are similar to those in the Soufriere Sulfur Springs and range from about 85 to 98 °C ((Joseph and Lindsay, Sampling of geothermal features in Saint Lucia and Dominica 14th-20th November 2002. 2002) and (Joseph and Robertson, 2003)). The pictures shown here are from 2008.

Figure 41 Looking down at the Valley of Desolation from the top of the path. Vigorous fumarolic activity is easily seen from great distances along the way.

Figure 42 Some of the active fumaroles found in the Valley of Desolation

Boiling Lake*

This is reportedly the second largest of its kind and features a drowned central fumarole which ranges from vigorous to mild activity. Temperatures and water level in this lake tends to vary based on the season. Water temperatures of up to 98 °C have been measured along the lakes edge during periods of vigorous activity. To the best of my knowledge, no temperature measurements have been made in the center of the lake due to accessibility issues. I did not visit the lake this trip but did so in 2008. The image below is from that visit.

Figure 43 The Boiling Lake during a period of high activity. The view of the lake is frequently obscured by a dense cloud of gases.

Day 13 – Pont Casse to Sineku – 7/2/2013

This hike continues across the interior of the island through some of the older deposits and ends on the east central coast of the island. Most of the outcrops on this side of the island are among the oldest here some dating back to the Late Miocene. In a few locations, there are outcrops of dikes off the coast which have been dated at about 3 million years. Among these dikes is L'Escalier Tete Chien, a much visited tourist site. Clear outcrops of this dike are visible in the ocean but it might also outcrop inland and extend all the way up to the mountain.

L'Escalier Tete Chien

15.466112°, -61.241594°

We did not get the best view of this dike since it was high tide by the time we made it to the view point. I was also unable to get any samples at that point.

Figure 44 L'Escalier Tete Chien at high tide.

Figure 45 Pillow basalts? from the viewpoint at the top of L'Escalier Tete Chien

Day 14 – Canefield/Mero – 7/3/2013

There was not much to see on this trip since the deposits here are part of the older/ancestral stratovolcanoes which have either been cannibalized by newer volcanoes or eroded away. There are perhaps lava flow outcrops in this area but I was unable to identify any.

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