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Edited by Sara Mana

Hawaiian Excursions - What does a semester abroad look like?

By Sharissa Thompson

Picture this; sunsets that stretch beyond the horizon, painting the sky vivid hues of purple, orange, and pink. Clear blue water with vibrant corals dotting the seabed beneath it. Palm trees stretching upward and bamboo stalks clacking in the gentle breezes. Warmth beyond comparison as the sun's rays bestow hot kisses upon your skin. Lush green mountain ridges ripen the land with their steep inclines and their wrinkled texture. All of this and more was only a simple application away through Salem State's National Student Exchange program (NSE for short). Through this program I was able to travel to the warm and sunny islands of Hawaii and for a semester become a student at the University of Hawaii at Manoa.

I stayed on campus at the University, nestled in at the entrance to the quiet valley of Manoa falls. My dorm room was situated on the tenth and highest floor of Gateway Hall above one of the university's dining halls, the Gateway Cafe. The view from the balcony outside of my room was breath-taking, the city of Honolulu lay before me in the distance, and far to the left stood the Diamond Head State Monument. In retrospect Diamond Head is an old volcanic tuff cone that had weathered down and grown vegetation, but still holds its magnificent shape with an elevation of 761 feet. During my last couple of days in Hawaii I was able to climb from the inside of the crater to its ridge and saw a different view of Honolulu laid out before me. In order to reach the inside of the crater a friend and I had to hike up the road after exiting the bus. When we reached Diamond Head there was a tunnel carved into the side large enough for two lane traffic and a tour bus to fit through. Walking through the tunnel, I couldn't help running my hands along the basalts that made up the tunnel's walls. Once reaching the inside of the crater we trekked across the middle to the other side stopping once to pay the dollar entrance fee and then we began our climb. This was not my only hike on the island, as I was able to roam freely and had student access to public transportation. Not only did I adventure on my own, but there were a few field trips that were both educational and fun.

For my semester away I really engaged myself in all science courses including, Hydrology, Astronomy, Oceanography, and the required Mineralogy class. For almost every class except for Mineralogy I had the chance to go on a field trip and explore the island with classmates. For my Oceanography class we had two field trips one for the lab and the other for lecture. For my Lab I helped to do a beach clean-up on the north shore part of the island. It was both depressing and eye opening to see how much plastic and other waste gets washed up on the north shore every day. A lot of people from all around the world, such as Switzerland, New Zealand, and Australia, came to help out hence there were a mingle of different accents. It was inspiring to see so many people passionate about keeping the Earth and the environment healthy and clean. Another memorable field trip I went on was for my Hydrology class. We visited one of the main groundwater reserves on the island (Figure 1). As I learned most of Oahu's tap water is derived from groundwater captured in dikes at the center of the island. For our field trip we were fortunate enough to actually walk inside one of these underground tunnels, where fresh water dripped from basalt ceilings, and a vault lay at the end of the tunnel held back an oasis of groundwater. The tunnel, without any light, was blacker than the night so we had to keep flashlights in hand to see. A

guide led us down the tunnel informing us about the history of how the groundwater dikes were first discovered and how the water system transformed over the years. Overall, during this trip I had so many great experiences from the educational aspect alone but extracurriculars were also a nice way to get around the island in fun groups. Even though I made a few friends in class, what really helped was the Geology & Geophysics Club. Much like our Geology Department, the number of students who major in the subject at the University of Hawaii at Manoa was relatively small forming a tight knit group. The students welcomed me with open arms and warm smiles. They helped guide me to the department offices so I could receive my passcodes and logins to be able to join them in their student lounge, which I might add is quite similar to ours just a smidge bigger. Once I began frequenting the lounge, they extended countless invitations to me starting with joining their Geology and Geophysics Club. The club runs many programs including having an intramural sports team or more-so competition with other non-sport clubs. We voted for ultimate frisbee and had the opportunity to go head-to-head with other clubs, who may have been slightly more prepared and competitive than we were. All competition aside, playing a team sport was a real bonding experience and brought me closer with the geology students in Hawaii.
All of the experiences I had in Hawaii were unique to the region, and I wouldn't have been able to discover so much if I had stayed in Salem. Being able to view the world and geology from different perspectives is a lesson I will not soon forget. With a simple application and interview process on campus I was able to affordably travel to a place that has always been on my bucket list. I am extremely happy and grateful that Salem State has this program and provided me with the means to fulfill one of my dreams. I highly recommend that if you're are able to academically allow a semester abroad to take the chance and travel.

Figure 1. Hydrology Field trips.Dike Groundwater Reserve group photo.

Trying to inspire the future generation

By Lisa Rusch (SSU alumni, 2017)

Think back to the moment you decided to study geology. What made you take that decision? While we all have our own paths to end up in this wonderful major, our choices can oftentimes be driven by a passionate educator. I think there is nothing more powerful than an energized teacher who brings the content alive and empowers their students to excel. At Salem State, we are fortunate to have amazing faculty in the Geology department who help undergrads find their love for geology. Unfortunately for me, I never liked science until college. I found high school classes boring, uninteresting, and irrelevant to my life. This shocks most of my students because now my career is teaching high school science and I love every minute of it. I am finishing up my first full year as a high school Earth Science teacher. This year I taught three sections of Earth Science and two sections of Marine Biology. I have had the opportunity to teach students in all

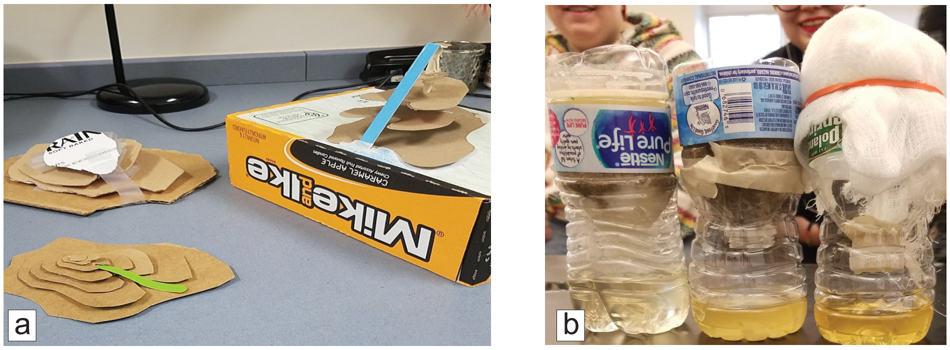

Figure 2. (a) Students made 3D models of topographic maps to identify where rivers flow; and (b) researched how water filters are made, and then "budgeted" to create a cost effective water filter.

four grades of high school and talk about science all day long. I recently got approved to create a new elective called "Science in Society" where students will be discussing the importance of science and its impact on the globe. I plan on focusing on pertinent topics such as climate change, vaccines, and our broken food system. Planning for these courses and grading was a lot to manage at first, but as the year progressed, I developed a more effective routine planning my class units in advance resulting in better and more meaningful units for my students. I consider myself fortunate because, as a high school Earth Science teacher, I am granted flexibility and independence in regards to the subject matter I am teaching. Being a teacher in a coastal community, such as the North Shore, allows me to show the relevance of what we are learning in the classroom and connect it directly to the physical world. After going outside to make direct observations, my students and I can debate the benefits and impacts of seawalls on the coastline, discuss erosional processes and make predictions to the past topography. The most difficult aspect of my job is learning how to prioritize information and capturing the students attention and interest. My students made fun of me for thinking rocks and minerals are cool and then during our rock unit many of them started to see that I am not crazy, even though I may be. But I think crazy is good! In today's world, I am competing with snapchat, facebook, texting, and so much more. This is as a challenge. How can I get my students to put their phone or laptop away for thirty minutes and think? How can I spark curiosity? Luckily, the science teaching community has developed a new strategy to encourage students to act as scientists by writing their own labs, building models, analyzing data, and much more. This new role, while sometimes very challenging for students, can also be empowering. So what did I do? I engaged them! They got to establish a protocol to determine the salinity of seawater; they built 3D models of contour maps to identify the location of rivers and more (Figure 2). During these projects, my students were acting like real scientist and they were proud. Teaching is a wonderful job, but believe me when I say it is hard. The days can be long. It is draining to tell the same student to get off facebook again (I now can relate to those college professors who are doing the same). Sometimes, the students can challenge you and may act out in a disrespectful manner, talk over you and waste everyone's time or be bored during your best lessons. Other times, you may find yourself acting as not just their teacher but also their therapist. But despite all this, there is no escaping it, if you like this job you will love your students as your own. You form a relationship with your students, and they may end up being the highlight of your day. After discussing the excess of plastic, a student may come into the next class with a reusable water bottle instead of the plastic one they normally bring. You begin to understand the impact you have on your students. A student may ask you to write them a letter of recommendation, lead a club, or come see their play. You may end up helping a student revive or build a passion for a subject, like science, that they might have given up on from past failures. You may still question whether you are doing a good job. But if you keep the passion and energy that drove you to love Earth Sciences, you will likely make a bigger impact on your students and you will get to spend your whole life being the reason someone else is driven to learn geology.

Amphibole: Garbage Mineral Supergroup

Mineral of the Month

By Cora Van Hazinga

Amphiboles have earned the name 'garbage can minerals'- they consist of varying amounts of sodium, calcium, magnesium, iron, and aluminum in a complex crystal structure. This structure allows for a lot of variation. There are 76 end members organized into five major groups that contain a dazzling array of impossible to memorize formulas. Amphibole is beautiful in its versatility. Colors can range from bright green (actinolite), sea blue (glaucophane), glossy black (hornblende) and white (tremolite). Sometimes it can be dangerous — brown asbestos is a member of the amphibole family.

All flavors of amphibole have the same basic structure: a double chain of silicate tetrahedra that runs parallel to the C axis. The chains are bonded by hydroxyl ions and cations in an octahedral (or even bigger) structure. This tetrahedral-octahedral-tetrahedral arrangement is called an I-beam, and gives amphibole its typical 60° and 120° cleavage (Figure 3).

This complex structure provides lots of room for chemical substitutions and diverse bulk chemistries. Amphiboles can be found in both igneous and metamorphic rocks; while they are rare in sedimentary rocks because they are hydrous and convert into clay during the transportation or lithification process. Hornblende, a very common amphibole, has the formula $(K,Na)_{0-1}(Ca,Na,Fe,Mg)_2(Mg,Fe,Al)_5(Al,Si)_8O_{22}(OH)_2$, living up to its garbage can reputation.

Identifying hand samples of amphiboles can be tricky. Hornblende can resemble its less complicated cousins, the pyroxenes. Both tend to be glossy and dark. They are both around 5-6 on Mohs hardness scale. However, pyroxene's inner structure is a simple single chain, giving it two cleavage planes that meet at nearly 90° and a more stubby habit. Hence, the prismatic crystal habit can be indicative together with the two distinctive planes of cleavage at 60° and 120°. Cleavage and habit distinguish amphibole from biotite as well (biotite is platy with only one well developed cleavage plane).

The various amphibole minerals look different in thin sections. Hornblende has yellow-green to brown pleochroism, similar to biotite, but lacks its characteristic bird's eye extinction. Simple twinning is common. Basal crystals are often, but not always, hexagonal.

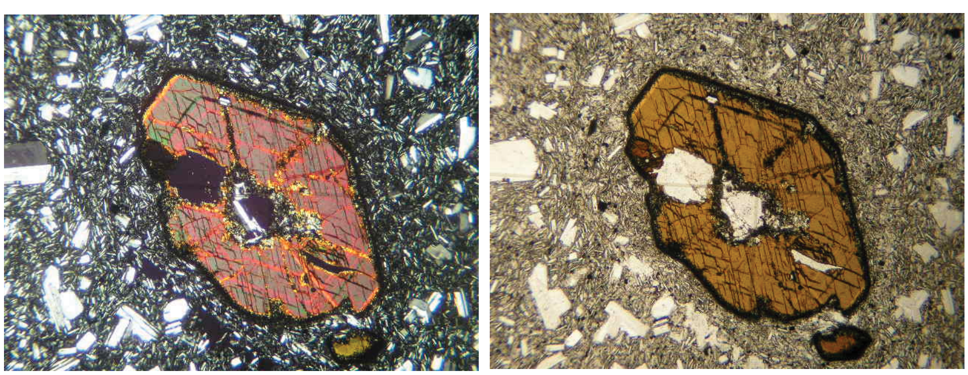

Figure 3. Hornblende in Thin section (a) PPL; (b) XPL. Notice the oxidation rim. Images from http://petrography.geology.uiowa.edu/thin-sections/igneous/

ESA News: (1) ESA elections were held on Monday, April 29. Next year, ESA representative will be Rebecca Wright (President), Klementina Mato (Vicepresident), Alyssa Cassias (Treasurer) and Eleanor Roccio (Secretary). (2) ESA is looking for volunteers to participate on the board and write short summary articles for future newsletters. Contact us at esa.salemstate@gmail.com

Student present their research at NEGSA

By Rebecca Wright

Four students from Salem State University presented their senior research projects at the 54th annual meeting of Northeastern Section Geological Society Association (NEGSA). The seniors who presented were Hannah Newcombe, Danielle Hartford, Marcello Toscanini, and Joseph (Franz) Blauss (Figure 4).

NEGSA is a geological annual conference that brings together geologist and students from the local section to present their latest research advancements, network, attend guest lectures and workshops, and be exposed to the current state of the art research and technologies. The conference was held on March 16th through the 19th in Portland (Maine) and hosted by the Maine Geological Survey, Maine Mineral and Gem Museum, S.W. Cole Engineering Inc., University of Maine in Farmington, and the University of Maine. The students presented their research during the poster sessions.

Figure 4. (a) Students at NEGSA 2019 in Portland, ME

Hannah Newcombe has spent the last school year working with advisor, Dr. J. Brad Hubeny. Newcombe's project, titled "Late Pleistocene to Middle Holocene Paleolimnological Variability Persevered in the sediments of Walden Pond, MA" looked at reconstructing climate change during the end of Pleistocene to mid-Holocene seen in the sediments in Walden Pond. Newcombe and Dr. Hubeny took core samples from Walden Pond. Bulk carbon dating for 11 of the samples was conducted by Woods Hole Oceanographic Institution, and Dr. Francene McCarthy, from Brock University, conducted preliminary pollen dating. Newcombe conducted isotopic and elemental analysis on Carbon, Nitrogen, and Sulfur isotopes.

Danielle Hartford is working with advisor Dr. Sara Mana on her research, "The Influence of Fractional Crystallization in the lava flows of Gelai Volcano." Hartford and Dr. Mana investigated the possibility of magma chamber recharge for Gelai volcano in Tanzania, East Africa. Hartford looked at the chemical composition of plagioclase phenocrysts present in a variety of lavas from Gelai volcano that Dr. Mana had collected. The plagioclases composition helps us look into the process of fractional crystallization and establish whether or not the system has been disturbed by magma recharge.

Franz Blauss has been working with advisor Dr. Lindley S. Hanson. Blauss's research was titled "Geophysical Investigations of the Cold River Valley, South Acworth, NH." Blauss was investigating the stratigraphy beneath the Cold River, a southwest flowing tributary of the Connecticut River. Seismic refraction and electrical resistivity techniques were employed by Blauss to refine the subsurface stratigraphy. Borings by the Department of Transportation had previous revealed a possible complex subsurface pre-Late Wisconsinan stratigraphy. Blauss's research looked further at the details of this stratigraphy.

Marcello Toscanini is working with advisor Dr. James Cullen and Dr. Patrick Getty, a paleontologist at Collins College in Texas. Toscanini's project, titled "Size Variation of Anomoepus Tracks in the Portland Formation at Dinosaur Footprint Reservation, Holyoke, MA" investigated the size variation of Ornithischian dinosaur tracks that spread across The Dinosaur Footprint Reservation in Holyoke, MA. Toscanini conducted field work with Dr. Getty where he identified tracks and mapped the size variation and spread. Statistical analyses of the sizes of these tracks are analysed to infer sex and age of the species that produced them.

NEGSA trip is an annual trip hosted by ESA. Information regarding the next NEGSA conference will be posted in room Meier Room 329 during the Spring semester. Abstracts are due in December.

The NAA - North Appalachian Anomaly

By Arianna Gaffney

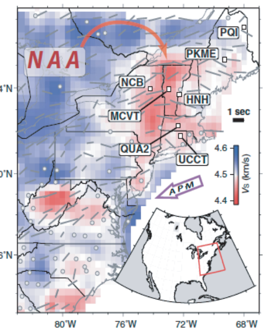

Figure 5. The NAA

A thermal anomaly has been found beneath New England! The article "Seismic evidence for a recently formed mantle upwelling beneath New England" by Levin et al. (2017) presented observations, including a significant reduction in shear wave velocity, supporting the presence of an interesting geodynamic process of localized mantle upwelling which has caught the eye of many geologists. Seismic studies of shear and compressional waves velocities show a "seismically slow feature" which is indicative of "a volume of significantly elevated temperatures in the asthenosphere". This region is not tectonically active so the estimated "~10% reduction in shear wave velocity affirmed that the NAA is a thermal feature" from upwelling in the mantle (Menke et al., 2016). The evidence for thermal upwelling suggests very early stage volcanism which hasn't yet been seen as "surface expressions (volcanism or uplift)" but may result in these features in many thousands of years. This unique feature has been named the "North Appalachian Anomaly (NAA) (e.g., Levin et al., 1995; Li et al., 2003).

Vadim Levin and his colleagues have studied this anomaly through the use of seismology including the splitting of seismic shear waves from distant earthquakes (Figure 5). The shear wave velocities are affected by variables such as temperature, pressure and composition. Seismology can detect the directional dependence or independence of the velocities. There is a "regional anisotropic fabric… that appears to be locally erased beneath central New England" (Levin et al., 2017), this paired with the elevated temperatures underneath this part of the craton reveal a strong possibility of upwelling in the upper mantle!!

At this years NEGSA there was a talk by Dallas Abbott from Columbia University who has done further studies about the NAA. Abbott and her team measured the temperature of a series of springs within New England, looked at S and P wave functions and previously published geochemical studies of anomalous 3He/4He isotope ratios in ground waters from springs around New England. The team found 3 springs with anomalous temperatures: (1) Sand Springs in Williamstown, MA has an anomalously high temperature of 14.3 degrees celsius about atmospheric temperature, (2) Lebanon Springs in Lebanon Springs, New York where the differential is 11.5 degrees celsius, and lastly (3) Northwest Hill Spring again in Williamstown, MA with an anomaly of 10.1 degrees celsius. These temperatures meet Gilbert's (1875) definition of a 'thermal spring'. The presence of these thermal springs in a tectonically inactive region suggest upwelling from beneath the New England Region corroborating Levin's hypothesis.

Next year Dr. Sara Mana and I, Arianna Gaffney, will be gathering data of CO_2 fluxes from springs within the New England region. CO_2 fluxes can be be related to a deep mantle signature and can help corroborate the present of a mantle upwelling beneath New England!

Sources: Levin, V., Long, M.D., Skryzalin, P., Li, Y. and López, I., 2018. Seismic evidence for a recently formed mantle upwelling beneath New England. Geology, 46(1), pp.87-90 and ref therein.