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Nuhou Kanaka Puka

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THE SPRING AND SUMMER 2018 ERUPTION OF KĪLAUEA



Photo by Bruce Houghton

The Spring and Summer 2018 Eruption of Kīlauea

In case you hadn’t heard, Kīlauea has dominated the geologic news for the past few weeks. G&G students and faculty, past and present, are involved with monitoring and studying this fascinating, but sadly, very destructive event. Most of the G&G ‘ohana has followed along with fascination thanks to webcams and detailed timely reports, images, and data from the Hawaiian Volcano Observatory (HVO), as well as with information from others on social media. HVO has an on-line chronology that is updated daily (or more frequently when necessary) **here**, and KHPR (Hawai‘i Public Radio) has their own until July 2, with even more details and links **here**. In these chronologies (as well as that which follows), keep in mind that there are essentially two simultaneous eruptions: 1) earthquakes, ground fractures, and eruptions in the lower East Rift Zone (ERZ); and 2) earthquakes, subsidence, and draining of the magma chamber up at the summit (Figure 1). Writing a chronology that keeps track of these two areas is difficult enough – imagine monitoring them both.

In the beginning: If you had tuned in at the end of April, the Kīlauea news featured a month or so of dwindling lava flows from Pu‘u ‘Ō‘ō. Rising lava levels in Pu‘u ‘Ō‘ō and at Halema‘uma‘u prompted HVO to issue a warning that new flows might break out of the Pu‘u ‘Ō‘ō edifice, posing potential hazards to anyone hiking (illegally) nearby. New flows could also eventually threaten different downslope areas of the volcano, as happened in 2014-2015 at Pāhoā. Instead, on the afternoon of April 30, all the lava stored within the Pu‘u ‘Ō‘ō edifice as well as in the shallow storage system beneath drained down into the ERZ plumbing system. A day later (May 1), summit tiltmeters recorded a switch from inflation to deflation. On May 2 the surface of the lava lake in Halema‘uma‘u began to drop.

(continued on next page)

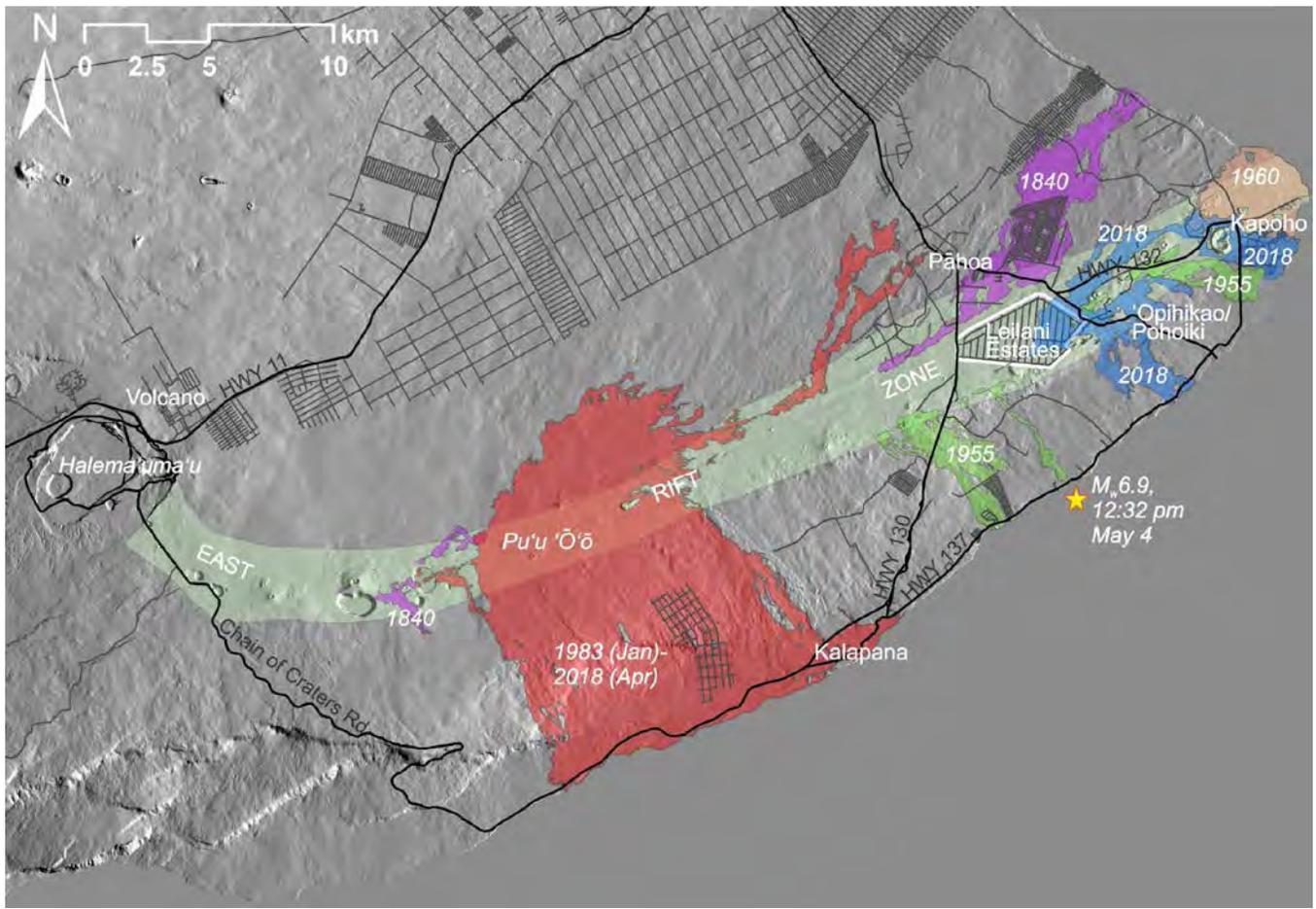


Fig. 1: Shaded relief image of Kīlauea summit and ERZ, showing locations mentioned in this article.

Magma migration to Leilani Estates: Over the next few days magma moved downrift from Pu'u 'Ō'ō, traceable via migrating seismicity, and HVO issued a notice that an eruption somewhere along the ERZ was a possibility. Preliminary InSAR and GPS results by Bridget Smith-Konter, Lauren Ward, and Liliane Burkhard (working with Xiaohua Xu and David Sandwell of UCSD; Figure 2) showed that the migrating magma produced at least 0.25 m of subsidence at Pu'u 'Ō'ō and as much as 0.15 m of uplift farther downrift, and the pattern is very complex. Seismicity began to concentrate under Leilani Estates subdivision, which sits in a shallow graben along the ERZ, about 2.5 km SE of Pāhoā and ~20 km downrift of Pu'u 'Ō'ō. Many of the earthquakes were so shallow that they were audible, and on May 2 cracks in roads were discovered within Leilani Estates. These cracks were concentrated along two sets ~900 m apart, both

striking parallel to the rift zone. Initially the cracks were cold, but by May 3 steam began to issue from some of those in the southern set and at around 5 pm that afternoon the first gas and spatter erupted from what became vent 1. Over the next 20 hours vents 2-6 opened, both uprift and downrift of vent 1. Samples of the lava and spatter were analyzed by UH-Hilo geochemist Cheryl Ganseki, using new rapid-analysis techniques, and they were found to not match the composition of Pu'u 'Ō'ō lava. Instead, it was "old" magma that had been stored within the rift zone, perhaps for decades. At public meetings soon after, HVO staff noted that the pattern of old magma being pushed out of the rift zone prior to the arrival of "fresh" magma had been observed during previous ERZ eruptions. The public and media were therefore aware of the possibility that hotter more voluminous fountains and flows might erupt in the future. For a brief while, non-

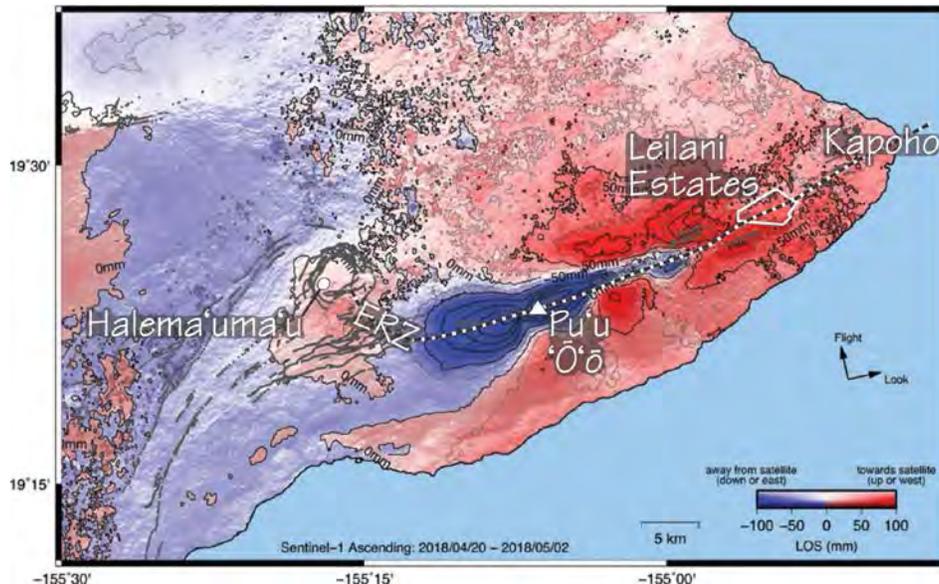


Fig. 2: InSAR-derived line-of-sight (LOS) ground deformation between April 20 and May 2 (i.e., encompassing the collapse of Pu'u 'O'o and beginning of dike emplacement into the lower ERZ). The satellite was looking from the WSW; ground surfaces that moved away (to the east and/or down) are shown in blue, and areas that moved toward (to the west and/or up) are shown in red. The ground motion contour interval is 50 mm; these values are the component of true motion projected onto the line of sight, and therefore minimum values. The radar incidence angle for this acquisition was 42.7° meaning that if vertical ground motion is assumed, the displacement values (positive or negative) can be multiplied by ~1.4.

geochemists and even normal people were discussing evolved magmas with high Zr concentrations.

The May 4 M_w 6.9 earthquake: In addition to the numerous small earthquakes within and near Leilani Estates, larger volcano-tectonic quakes occurred on May 3 and 4. The largest of these occurred at 12:32 pm on May 4, with a moment magnitude (M_w) of 6.9 and an intensity of VI along the S coast of Hawai'i (it was felt by many people in POST). Its epicenter was just offshore and ~12 km SSW of Leilani Estates (Figure 3). According to the National Earthquake Information Center the earthquake was a thrust event with a preliminary focal depth of 2.1 km on a plane striking 240° and dipping 20° inland. G&G alumnus Nathan Becker, at the Pacific Tsunami Warning Center, noted that although the initial break was shallow and corresponds to a shallow thrust fault within the outer bench (identified by G&G alumnus Denise Hills and former SOEST Young Investigator Julie Morgan in 2002), the bulk of the

motion took place deeper, on the basal décollement between Kilauea and the old ocean floor. Preliminary InSAR and GPS results by Smith-Konter's team plus G&G alumnus James Foster (HIGP) indicate that much of Kilauea's south flank moved oceanward by as much as 0.75 m. The earthquake generated a small tsunami along the SE coastline of Hawai'i (40 cm at the now-buried-by-lava tide station in Kapoho) and shook loose a dramatic plume of reddish oxidized dust from Pu'u 'O'o.

Early flows in Leilani Estates: Meanwhile in Leilani Estates, ground cracks continued to extend as far uprift as HWY 130 and as far downrift as Pohoiki Rd. By May 6, 12 of these cracks had erupted spatter and/or lava, but only vent 8 generated a significant flow, which sadly, destroyed about 20 homes in the afternoon and evening of May 6. Bruce Houghton spoke movingly of encountering Leilani Estates residents who had lost everything they owned. By May 9, vents 13, 14, and 15 opened, extending the eruption just outside (in a

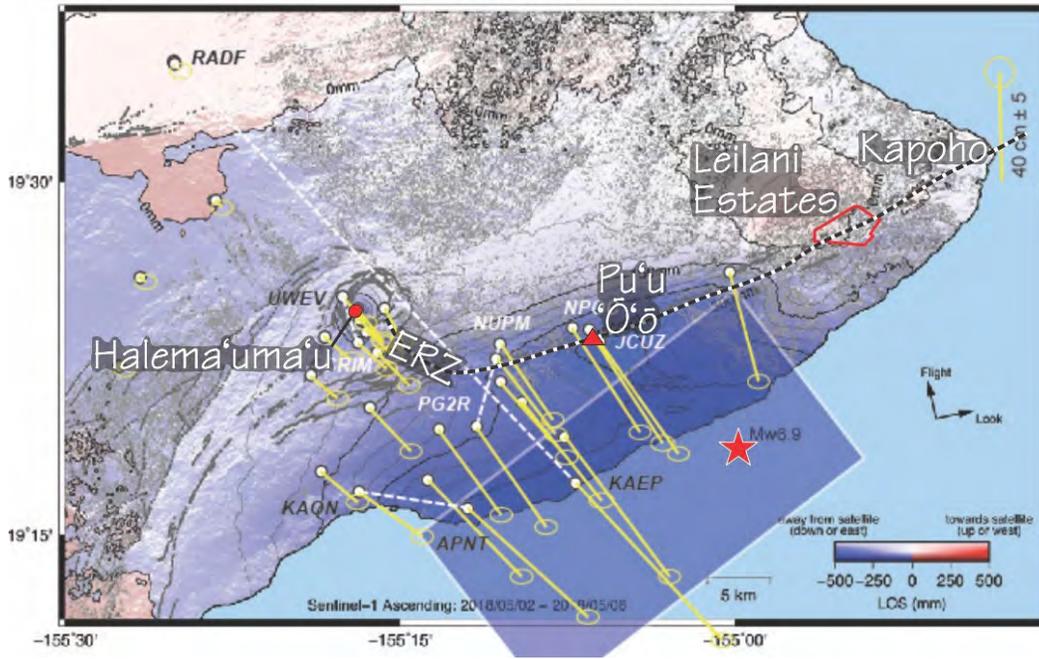


Fig. 3: GPS motion vectors (yellow), InSAR LOS motion, and preliminary estimate of ruptured fault plane for the May 4 2018 Mw 6.9 earthquake (red star). This was a low-angle thrust event with uplift inferred offshore. The largest offset was ~ 75 cm measured at station KAEP, on the coast. LOS motion also suggests significant horizontal SE-directed motion.

downrift direction) Leilani Estates and into a subdivision called Lanipuni Gardens. Vent 15 was the first to erupt a composition dominated by “fresh” Pu’u ‘O’o magma, but it did not produce significant fountaining or flows.

The pre-eruption slopes dictated that lava erupted within Leilani Estates would flow NE, exit the subdivision, and continue NE, constrained to the SE by a row of old scoria cones. Lava from the downrift parts of the vent system (i.e. outside of Leilani Estates), however, would head either NE along the S side of these same old cones or S and SE toward the coast into the ‘Opihikao/Pohoiki area, potentially threatening a large area of scattered homes and farms.

Halema’uma’u lava lake draining and hydromagmatic explosions: By May 6, the summit lava lake had dropped to 220 m below its rim, a rate of 55 m d^{-1} . Scientists at the USGS and in G&G began to discuss publicly a repeat of the 1924 explosive

eruption when (as had long been thought to have been the case) a long-lived lava lake dropped low enough to interact explosively with the water table. On the morning of May 9 HVO issued a public announcement that due to the continued dropping of the Halema’uma’u lava lake, there was a possibility that hydromagmatic explosions might occur. Half an hour later a landslide into the (now very deep) lava lake triggered an explosion which many interpreted to be the first such hydromagmatic event, although it was not. That evening, during a **public presentation** at Hawai’i Volcanoes National Park, HVO scientists forecasted that at the current rate of lake-level drop (2.2 m hr^{-1}), it should reach the depth of the water table (~ 400 m below the floor of Halema’uma’u) in about a week, at which time, if the 1924 analogy is correct, explosive water-lava interactions could be expected. Hawai’i Volcanoes National Park closed to the public on the evening of May 10 due to concerns about potential explosions and ash accumulation, as well as cracked roads and

overlooks. Except for the Kahuku section on Mauna Loa's SW rift zone, the park remains closed as of this writing (early August).

“Fresh” and very old lava erupting at the lower ERZ: No eruptions of spatter or lava occurred on May 10 or 11 in or near Leilani Estates, although copious SO₂ issued from existing vents and cracks. Around this time Steve Businger (UHM Atmospheric Sciences) estimated that the SO₂ output had doubled from its early-April amount, but he said that number was very uncertain. Over the course of May 12-15, vents 16-19 opened, all of which were within or downrift of Lanipuni Gardens subdivision, and all of which initially produced only small amounts of lava. Vent 17, the farthest downrift but

not along the strike of all the others (Figure 4), produced fountains as high as 125 m, a scoria and spatter cone, and a lava flow that eventually extended almost 2.5 km NE and then SE. At this point the vent 17 flow was the most voluminous that had been produced. Interestingly, Cheryl Ganseki's analyses showed that the vent 17 flow is andesite! Likely this magma was sitting in the rift zone for a long time differentiating, and as the 2018 dike passed by, it squeeze the differentiated magma sufficiently to get it to erupt. The vent 17 eruptions were accompanied by percussive steam explosions, indicating interaction with shallow groundwater. Some of these were audible in Mountain View, 25 km away.

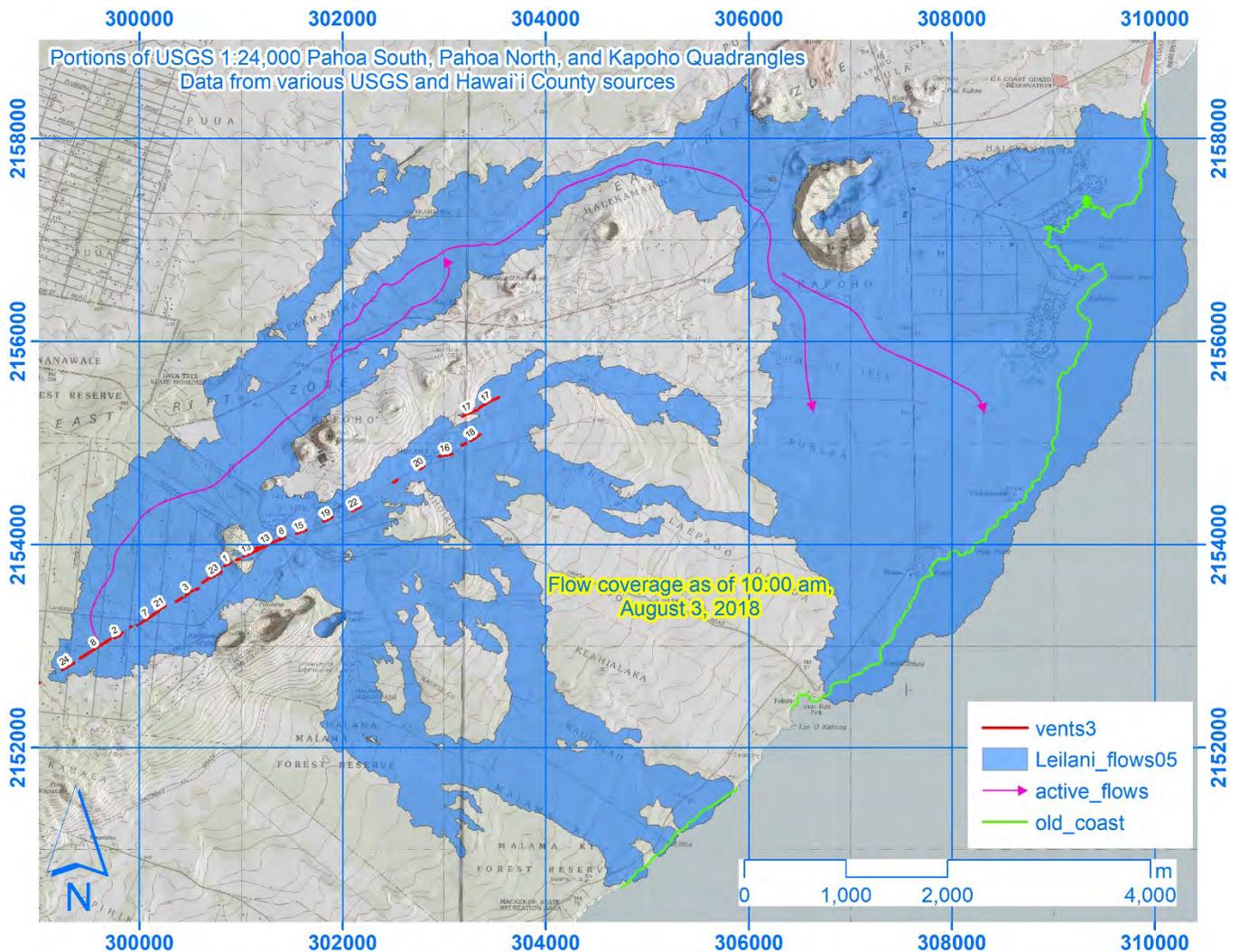


Fig. 4: Vent and flow map as of August 3, 2018.

Explosive eruptions at Halema'uma'u: The first explosions from Halema'uma'u that were interpreted at least partly to be hydromagmatic occurred the morning of May 15. Explosions continued throughout the day with ash clouds reaching 3600 m above the summit. Ash was blown SW into the Ka'u desert and as far as Pāhala by tradewinds (Figure 5). Another explosion the following morning threw ballistic blocks up to 60 cm across onto the (closed since 2008) Halema'uma'u parking lot. Cracks opened on HWY 11 near the entrance to the National Park, an indication that subsidence of the summit was not restricted merely to Halema'uma'u.



Fig. 5: Gas and ash plume from Halema'uma'u, viewed from the Volcano Golf course. Photo by recent G&G grads Ryan Hendrix and Shyun Ueno.

Effusion rate increases from lower ERZ vents: The situation on the lower ERZ continued to be relatively quiet from May 15-17, although by then vents 20, 21, and 22 had all opened. Things changed rapidly on May 19, when fissures 16, 18, 19, and 20 merged into a single, ~2 km-long line of fountains (Figure 6) and the combined effusion rate increased significantly. At least 6 channel-fed 'a'a flows advanced rapidly to the S and SE toward Pohoiki and Opihikao, destroying homes, farm buildings, and farmland, and eventually cutting the coastal "Red Road" (Hwy. 137). Lava reached the ocean at 10:45 pm on May 19. Eventually 3 separate ocean entries

were established. Large plumes of steam, glassy fragments, and HCl aerosols (lava haze or laze) were generated. The laze plumes briefly were all the rage among the news media, who seem to have forgotten that between 1986 and early 2018 laze was produced almost constantly by Kūpaianaha and Pu'u Ō'ō flows entering the ocean. The combined vents 16-22 erupted vigorously through around May 24, when activity started to wane. Lava stopped flowing into the ocean sometime around May 28 or 29.



Fig. 6: Near-nadir helicopter view of vents 16, 18, 20, and 22 producing fast-flowing lava on May 19. Vent 17 (barely active by this time) is at the top. Photo by recent G&G grads Ryan Hendrix and Shyun Ueno.



Fig 7: View upflow (SW) of middle few km of the active vent 8 lava flow. Older flows at far left erupted from vents 16-22 from May 19-22. Photo by Bruce Houghton.

Coinciding with the decreased output from vents 16-22, activity returned to Leilani Estates. Lava from vent 7 flowed north and northeast, exited the subdivision, and crossed Pohoiki Rd. on May 26. The same day, vent 8 reactivated and produced a fast-moving flow that paralleled the north margin of the vent 7 flow, passed it, and crossed Hwy 132 near the Puna Geothermal access road. Fountains at vent 8 consistently reached 60 m and since May 27 this vent has dominated the output in the lower ERZ. HVO estimated an effusion rate of $\sim 100 \text{ m}^3 \text{ s}^{-1}$, which has changed little through mid-June. The flows from vent 8 continued NE until they passed the downrift end of the older cones mentioned above, at which point they turned toward the east. The fastest of these flows had advanced 7 km from vent 8 by May 31 and based on steepest downslope paths it was clear that Kapoho was in danger.

At 9:30 am on June 2, the vent 8 flow crossed the intersection of Hwys 132 and 137 (the “4 corners”) and almost immediately made a 90° turn to the south, topographically constrained by the 1960 lava flows and Kapoho Cone. A small finger of the flow turned SW into the bowl of Kapoho Cone and entered Green Lake. By that afternoon the lake had boiled away. The majority of the lava flowed S past Kapoho Cone and then turned E and SE toward the coastline. The topography in that area is very

gentle, which caused the flow front to slow and widen. For a while on June 3, the active flow front was almost 1 km wide. Late on the evening of June 2 lava entered Kapoho Bay and began filling it. By the next afternoon the bay was completely filled and replaced by a peninsula of land extending as much as 300 m beyond the average coastline. A second branch of lava headed more SE, entered the ocean and then spread N to merge with the Kapoho Bay flow, producing a line of new coastline more than 2 km long (Figure 8). As of this writing, vent 8 has maintained fountain heights of 40-60 m and lava has continued to enter the ocean. The flow is about 13 km long from vent to coast. The first 10 km or so is distinctly channelized (Figure 7) and the last 3 km or so is more diffuse. Reports of strong thermal upwelling and occasional explosions 10s of m offshore indicate that the flow maintains reasonable coherence below the surface. Assuming that the $100 \text{ m}^3 \text{ s}^{-1}$ effusion started when vents 16, 18, 19, and 20 merged on May 18 and has held steady since



Fig. 8: Lava entering the ocean at the former location of Kapoho. Photo by Julia Hammer, June 11.

then, $276 \times 10^6 \text{ m}^3$ of lava erupted as of June 20 (this writing). A little more than $216 \times 10^6 \text{ m}^3$ of this has come from vent 8. Sadly, almost 600 homes, most of which were in the Kapoho area, were destroyed as the vent 8 lava flow advanced to the ocean.

Puna Geothermal plant: Much of the public concern in and around Leilani Estates revolved around the Puna Geothermal Venture (PGV) powerplant, which is just north of the subdivision. Many residents are unhappy about PGV to begin with, and the stress of an ongoing eruption didn't help the situation. The two main worries were that: 1) tanks of pentane, which is used in a secondary heat-extraction process, would explode; and 2) hydrogen sulfide would be released if lava somehow made it down into the geothermal wells themselves. PGV shut down their operations shortly after the eruption crisis began, and by May 9 had moved all the pentane off-site. They eventually filled all the wells either with cold water or drilling mud and capped them to prevent any lava inflow. To date, two well sites have been buried by lava.

Summit collapse and the growth of Halema'uma'u: Up at the summit all this time, subsidence, slumping, landsliding, and episodic explosions of gas and ash continued. The last time the lava lake was visible (from a helicopter) was the second week in May, at which time it was $>300 \text{ m}$ below the floor of Halema'uma'u. As the lake level dropped, the now unsupported walls of the Overlook vent started to collapse, enlarging the vent from a diameter of $\sim 200 \text{ m}$ in late April when the lake last overflowed, to almost 1 km by late May. Concentric fractures in the floor of Halema'uma'u were observed in mid-May and soon after that the floor began to slump into the expanding Overlook vent. Around the end of May, concentric fractures appeared on the main caldera floor W and NW of Halema'uma'u, and by June 2 the caldera floor had begun to slump into Halema'uma'u. Around June 10, additional concentric fractures appeared on the caldera floor, this time N and NE of Halema'uma'u, and by June 12 they too had become the headwalls of slumps. By June 20 these two sets of slumps had merged and new concentric fractures were forming on the caldera floor 900 m east of the old

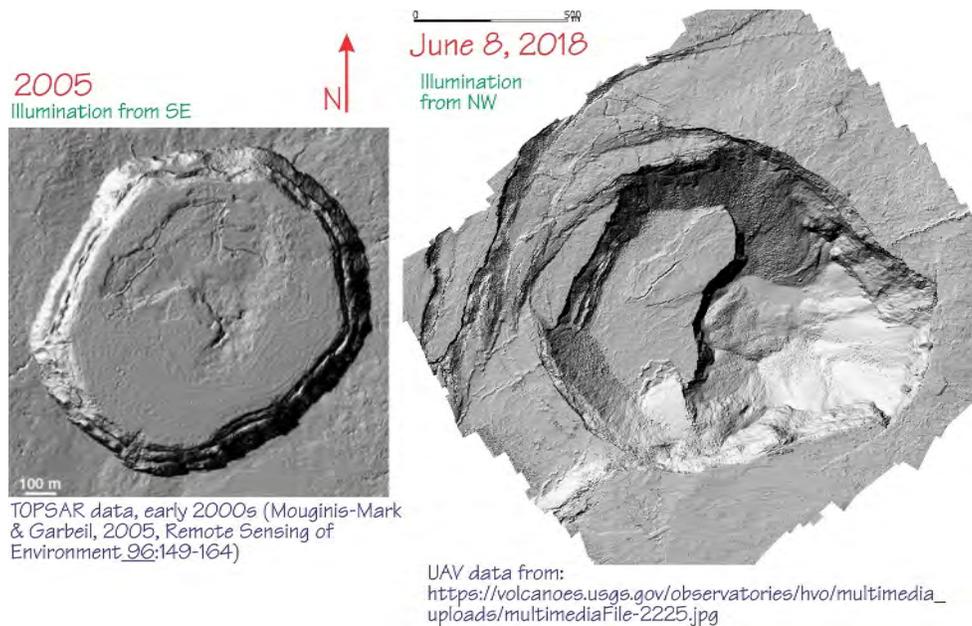


Fig. 9: Comparison of shaded relief images of Halema'uma'u in 2005, i.e. before the Overlook vent developed, and on June 8 2018 (north is up in both). The June 8 data is already outdated; as of June 20 the caldera floor NE of Halema'uma'u has collapsed along scarps almost as far as the edge of this image.

Halema'uma'u crater rim. The changes to Halema'uma'u and the caldera as a whole are astounding (Figures. 9, 10).



Fig. 10: View westward across the southern edge Halema'uma'u, June 12. HVO image from: https://volcanoes.usgs.gov/observatories/hvo/multimedia_uploads/multimediaFile-2239.jpg

In addition to the brittle failure within and outside Halema'uma'u, coherent summit subsidence has continued since May 1. This subsidence is recorded on HVO tiltmeters as well as by Bridget Smith-Konter's team's InSAR data. Preliminary InSAR data indicated 2 - 2.4 m of subsidence of the main caldera floor by early June, not counting the areas that had slumped. Almost 4 m of subsidence occurred over ~3 weeks in 1924, as a comparison.

G&G Dept. contributions: The contributions to monitoring and studying this eruption by G&G are extensive. First, Bruce Houghton, Hawai'i State Volcanologist, has been at the eruption more or less every day since May 1, observing the initiation of new vents, channel formation, Hawaiian fountains, and everything else. Brett Walker, one of Bruce's PhD students has also been working with the ERZ field crews. Bruce's recent student, and current postdoc, Samantha Isgett has been working with Don Swanson monitoring changes at Halema'uma'u and studying ash plumes from the summit explosions. G&G is proud to have trained 5

members of the permanent HVO staff: Jim Kauahikaua, Matt Patrick, Carolyn Parcheta, Frank Trusdell, and Brian Shiro, all of whom are working extremely long days during this event. Wendy Stovall, another G&G graduate, now at the Cascades Volcano Observatory and associate Scientist in Charge at the Yellowstone Volcano Observatory, rotated in for 2 weeks in mid-May, as did Tim Orr, now working at the Alaska Volcano Observatory.

Nick Turner, recent G&G graduate, worked with UH-Hilo colleagues flying UAVs with thermal cameras. Elise Rumpf, now a postdoc at Lamont-Doherty, also collected data via UAV. Combined, Ken Rubin, Scott Rowland, Julia Hammer, Tom Shea, and Mike Garcia have given almost 100 interviews about the eruption with print, on-line, radio, and television media. Colleagues in Atmospheric Sciences and HIGP have contributed to this effort as well, which HVO really appreciates.

No matter what the eruption decides to do, the work will continue. Ken Rubin, Mike Garcia, Julia Hammer, Tom Shea, Jasper Konter, Clara Solara, Val Finlayson, Adrien Mourey, and Rebecca DeGraffenried will be studying various aspects of the eruption and erupted products with support from a Grant for Rapid Response Research (i.e., the "RAPID" program of the NSF). Study topics include degassing processes, flow emplacement and rheology, compositional evolution of the magma, and diffusion chronology to date magmatic events that occurred before eruption. Bruce Houghton received a \$475K achievement-based renewal award from the NSF to study the mechanisms of the 2018 explosions, working with USGS partners Matt Patrick, Carolyn Parcheta, Tim Orr (all G&G alumni) and Tricia Nadeau. G&G's geophysicists also submitted a USGS Earthquake Hazards Proposal in mid-May to study the regional deformation and stress changes caused by the eruption. G&G Alum. Jackie Caplan-Auerbach (Western Washington U.) and former SOEST Young Investigator Julia Morgan received funding to deploy Ocean Bottom

Seismometers (OBSs) offshore, and to map the new lava flows with side-scan sonar.

It is always difficult to summarize an ongoing eruption. Since this article was written (mid-June), vent 8 continued to produce $\sim 100 \text{ m}^3 \text{ s}^{-1}$ of lava through the end of July (according to the USGS), and almost all of it flowed through a remarkably stable channel down the rift zone through what was once Kapoho, and into the ocean. Almost 8 km of coastline have been buried, and in places built out $>1 \text{ km}$. Assuming this eruption rate was established May 19 at vents 16, 18, 19, and 20, and continued through the end of July, the total erupted volume has been $>640 \times 10^6 \text{ m}^3$. Meanwhile, collapse continued at the summit through July, marked by an amazingly regular cycle of increasing seismicity culminating in a $M_w 5.3$ earthquake and down-drop of the caldera floor, followed by a couple hours of seismic quiet and then increasing seismicity

culminating in a $M_w 5.3$ earthquake and down-drop of the caldera floor, followed by a couple hours of seismic quiet and then increasing seismicity culminating in...(you get the picture). The thousands of felt earthquakes have many residents of Volcano on edge, according to GG alumnus Darcy Bevens (now at CSAV/UH-Hilo). Collapse at the summit is centered on Halema'uma'u, and although difficult to quantify, the volume loss is essentially equal to that erupted on the LERZ. Meanwhile, Jackie's and Julia's cruise deployed OBSs and mapped some of the new offshore flows, with a science crew that included GG undergraduate students Natalie Powers and Brian Swilley, and graduate student Brett Walker.

This article was written by Scott Rowland, with considerable help from (in alphabetical order): Val Finlayson, James Foster, Mike Garcia, Julia Hammer, Bruce Houghton, and Bridget Smith-Konter.



Vent 8 (bright, in the distance), the silhouette of Kapoho Cone (far lower right), and a broad ocean-entry south of Kapoho, photographed by GG alum. Jackie Caplan-Auerbach from the deck of the Ka'imikai-O-Kanaloa, July 11, 2018. Jackie writes "This part is hard – we're finally near the ocean entry, where lava from Kīlauea is entering the ocean at Kapoho. It's beautiful and dynamic, but also painful, given the homes and communities that have been lost, and the number of people who have been impacted by this eruption."

* * *

Message from the Outgoing and Incoming Department Chairs

Aloha everyone! The 2018-19 academic year will soon be upon us. We would like to welcome our new and returning undergraduate and graduate students.

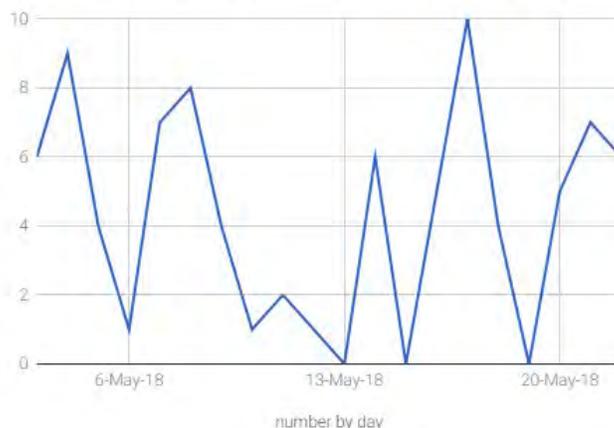
I (Ken) want to say that it has been a pleasure to serve as your Chair for the past 4 years and to thank everyone for their great support and participation in department activities during a challenging time at UHM. Please join me in welcoming Paul Wessel as our new Chairperson! Paul will bring his well-honed skills developed during his prior stint as chair in the early 2000s to move GG forward on efforts focused on student learning and research. And I (Paul) and the rest of the department want to offer Ken Rubin a heartfelt Mahalo for his tireless and effective leadership on behalf of all of us for the past 4 years. Ken has been perhaps the most active and hardworking Chair we have had during my tenure, and he has set a wise and exciting course for our academic enterprise that we hope will continue to grow in both the online and physical domains. I intend to continue his efforts and also try to expand our collective footprint in extramurally funded research.

As is customary in this column, we want to inform readers from throughout the GG 'ohana of some high points of the past and upcoming academic years:

The Department of Geology and Geophysics remains a strong and vibrant place of learning, and as a unified community of scholars. Our research enterprise is thriving, and our classes are full of learners from across campus. This is illustrated so well by the series of dramatic events that began in early May at Kilauea volcano (and continue as of this writing), with a substantial research effort by several of our faculty members and their research groups (Bruce, Mike, Tom, Julia and Ken), a media blitzkrieg by several of those folks (including 84 interviews, many on live local and international

TV/radio) in the first 3 weeks of the Leilani Estates eruption (HVO Eruption “Episode 62”) – see the figure – and a very energized faculty and student body learning about and exchanging ideas on the eruption and its historical context.

2018 Kilauea Media appearances by GG faculty



In other department news, we welcome our newest faculty member, Tom Shea (Volcanology/petrology) this July and bid farewell to our long-time colleague Janet Becker, who has moved on to UCSD. We also saw our foray into online offerings of 101 and 100L blossom, with multiple sections a semester, filling soon after we open them. Please follow our efforts as we work to bring more courses to the online space and explore online offers at the upper division and graduate level.

Undoubtedly the upcoming academic year will bring new opportunities and challenges. The department began a strategic planning process about future hires, focuses of the department, and the changing research and teaching landscape this past year, and concluded a long and spirited discussion about a department name change. Stay tuned to see if our proposal is approved by UHM! We also discussed modifications to the undergraduate curriculum to broaden and modernize it, and to make it accessible to ever more incoming students.

We are very pleased to announce the funding of a research fellowship for GG students by long-time department friend Don Swanson, the ongoing award from the Bullard family, annual field trip fund support from Mike Jackson, and many others, including alumni, who contribute to our UHF funds. We put all that money to work for our students. If you have not already done so, please consider a (tax

deductible) contribution to one of the Department's funds (donate from the following website, <https://giving.uhfoundation.org/give/giving-gift.aspx?allocation=12077204> or click the "donate" button on the GG home page).

Finally, please accept our very best wishes for a happy 2018-2019 Academic Year!



Ken Rubin and Paul Wessel

* * *

Degrees, Awards & Honors

UNDERGRADUATES

Samuel Clairmont	<i>BS Summer 2017</i>
Sebastian Smith	<i>BS Fall 2017</i>
Kyle Burns	<i>BA Spring 2018</i>
Catherine Morgan	<i>BA Spring 2018</i>
Ryan Twigg-Smith	<i>BA Spring 2018</i>
Gianni Cuadrado	<i>BS Spring 2018</i>
Justin Higa	<i>BS Spring 2018</i>
Zachary Langdalen	<i>BS Spring 2018</i>
Aaron Lee	<i>BS Spring 2018</i>
Amber Mokolke	<i>BS Spring 2018</i>
Caroline Tisdale	<i>BS Spring 2018</i>
Jason Tremblay	<i>BS Spring 2018</i>

MASTERS OF SCIENCE – PLAN A THESIS

http://www.soest.hawaii.edu/GG/resources/gg_theses.html

Brett Walker – *Petrologic Insights into Rift Zone Magmatic Interactions under Kīlauea’s Nāpau Crater (1922-2011) (Advisor: M. Garcia, Summer 2017)*

Nicholas Turner – *Lava Flow Hazard Prediction and Monitoring with Unmanned Aerial Systems: Case Studies from the 2014-15 Pāhoā Lava Flow Crisis, Hawai’i (Advisor: B. Houghton, Spring 2018)*

Daniel Dores – *Stable isotope and geochemical source-tracking of groundwater and surface water pollution to Kāne’ohe Bay, Hawai’i (Advisor: C. Glenn, Summer 2018)*

Catherine Hudson – *The Source and Magnitude of Submarine Groundwater Discharge Along the Kona Coast of the Big Island, Hawaii (Advisor: H. Dulai, Summer 2018)*

Michael Mathioudakis – *Hydrology of Contaminant Flow Regimes to Groundwaters, Streams, and the Ocean Waters of Kane’ohe Bay, O’ahu (Advisor: C. Glenn, Summer 2018)*

MASTERS OF SCIENCE – PLAN B NON-THESIS

http://www.soest.hawaii.edu/GG/resources/gg_ms_final_reports.html

Genesis Berlanga – *Remote Raman Detection of Natural Rocks (Advisor: A. Misra, Summer 2017)*

Casey Honniball – *Spectral Response of Microbolometers for Hyperspectral Imaging (Advisor: R. Wright, Fall 2017)*

Brytne Okuhata – *Development of a Model to Identify Local Hydrogeology and Simulate Groundwater Injection in Nuuanu and Kalihi Aquifer Systems (Advisor: A. El-Kadi, Fall 2017)*

Warren McKenzie – *Integrating Orbital Chemical Mapping and Geological Mapping (Advisor: J. Taylor, Spring 2018)*

Diamond Tachera – *A Hydrogeochemical Analysis of Geothermal Resources in the State of Hawai’i (Advisor: N. Lautze, Spring 2018)*

Trista McKenzie – *Kāne’ohe Bay and Watershed: a Review of its Hydrogeology, Historical and Current Sources of Pollution and Methods to Quantify Pollutant Fluxes and Sources (Advisor: H. Dulai, Summer 2018)*

MASTERS OF GEOSCIENCE FOR PROFESSIONALS

http://www.soest.hawaii.edu/GG/resources/gg_mgeo_project_reports.html

Robert Walker – *Short-Term Shoreline Change on O’ahu’s North Shore During a Strong El Nino Year (Advisor: N. Frazer, Fall 2017)*

Elise Leroux – *Mapping the Susceptibility to Slow-Moving Landslides on O’ahu (Advisor: G. Apuzen-Ito, Spring 2018)*

DOCTOR OF PHILOSOPHY

http://www.soest.hawaii.edu/GG/resources/gg_dissertations.html

Valerie Finlayson – *Investigations of Southwest Pacific Intraplate and Backarc Volcanism Using Traditional and Non-Traditional Isotopes (Advisor: J. Konter, Summer 2017)*

Emily First – *Magmatic Environments and Time-scales: Experimental Studies on Martian Basalt and Terrestrial Dacite (Advisor: J. Hammer, Fall 2017)*

Samantha Isgett – *Conduit and Eruption Dynamics of the 1912 Vulcanian Explosions at Novarupta, Alaska (Advisor: B. Houghton, Fall 2017)*

Marissa Cameron - *Morphological Mapping and Tidal Stress Modeling of Strike-Slip Faults on Ganymede (Advisor: B. Smith-Konter, Spring 2018)*

Andrea Gabrieli – *Remote Measurements of Volcanic Gases Using Thermal Infrared Hyperspectral Imaging (Advisor: R. Wright, Spring 2018)*

Estelle Bonny – *Multi-Decadal Space-Based Observations of Basaltic Effusive Eruptions from Modis Infrared Data (Advisor: R. Wright, Summer 2018)*

STUDENT AWARDS

AGATIN ABBOTT MEMORIAL AWARD

Presented to the outstanding senior, annually, in memory of department faculty Agatin Abbott.

Justin Higa

FRED M. BULLARD FELLOWSHIP

Endowed by Thais Freda Bullard in memory of her father, Fred M. Bullard, a pioneer in the studies of Volcanology and general Geology & Geophysics.

Hannah Shelton, Samuel Mitchell, Lauren Ward

WILLIAM T. COULBOURN FELLOWSHIP

Endowed by friends and family in memory of department alumnus / faculty member William T. Coulbourn.

Trista McKenzie

HAROLD T. STEARNS FELLOWSHIP

Endowed by longtime department friend for the purpose of supporting student research on geological and geophysical problems in Hawaii and the Pacific Basin.

Daniel Dores, Katherine Herries, Charu Lata

DONALD A. SWANSON FELLOWSHIP

Endowed by longtime department friend to support graduate students in costs associated with UH attendance and field work.

Rebecca deGraffenried

J. WATUMULL SCHOLARSHIP

Awarded annually to the department's outstanding graduate student from an endowment from the Watumull Foundation.

Xiaojing Lai, Andrea Gabrieli

ARCS AWARD

Awarded by the Achievement Rewards for College Scientist Foundation.

Haunani Kane

GG ACHIEVEMENT SCHOLARSHIPS

Award based on merit service, achievement and outstanding grades of graduates.

Andrea Gabrieli, Katherine Herries, Yi Hu, Samantha Isgett, Alexandra Pleus, Diamond Tachera, Christopher Shuler, Samuel Mitchell

OTHER FELLOWSHIP, SCHOLARSHIPS & AWARDS

Trista McKenzie won the 2017 first place on AGU virtual poster competition.

* * *

2017-2018 GG Faculty Research & Teaching Highlights

Garrett Apuzen-Ito is advising **Alexandra Pleus** who is modeling gravity data collected onboard the Schmidt Institute's R/V *Falkor* to study the strength of the Pacific plate as it buckles due to the weight of the Hawaiian seamount chain. Congratulations to **Elise Leroux** for successfully completing her MGeo degree! Elise worked with Garrett to analyze geologic and environmental data and create a map of Oahu showing the susceptibility for slow-moving landslides. The map is intended to influence decisions made by developers in the areas of elevated risk. Garrett is completing projects with **Samuel Howell (Ph.D 2016)**, now a postdoctoral scholar at the JPL (Pasadena CA) and **Jonathan Weiss (Ph.D 2016)**, now a postdoctoral scholar at Leeds University UK. Congratulations Jonathan for having his third dissertation chapter on the formation of thrust faults and accretionary prisms accepted for publication! Garrett continues to work with **Nicole Lautze's** (HIGP) group, **Neil Frazer**, **Steve Martel**, on a DOE-funded project to search for geothermal energy resources in Hawaii.

Several students advised by **Henrietta Dulai** graduated this academic year and their thesis projects provide a good overview of her current research activities. **Elizabeth Dionne**, a GES undergraduate student, co-advised by Dulai and Oceanography colleague Dr. Ho defended her GES BS thesis "Resolving carbon contributions in a mangrove estuary" in Fall 2017. Liz is currently working on her degree in G&G's MGeo program. In the spring/summer of 2018, there were 3 students graduating. GES undergraduate student, **Eric Welch** completed and defended his BS thesis titled "Field assessment and groundwater modeling of pesticide distribution in the Faga'alu watershed on Tutila, American Samoa. Eric will be starting on his G&G MS degree in the Fall. **Trista Mckenzie** defended her MS thesis titled "Kaneohe Bay and watershed: a review of its hydrology, historical and current sources of pollution and methods to quantify pollutant fluxes

and sources." Trista is continuing on for her PhD to work on contaminant transport and mapping as well as tracing technique development. **Catherine Hudson** defended her MS thesis titled "The source and magnitude of submarine groundwater discharge along the Kona coast of the Big Island, Hawaii." Dulai has spent this past academic year on sabbatical in Hungary where she collaborated with colleagues on radon and thoron tracing of thermal springs.

Robert Dunn continues research on the volcanic, tectonic, and hydrothermal processes occurring along the Mid-Atlantic Ridge. Building on several earlier papers from his group, an additional micro-earthquake study was published this year and he continues to oversee seismic imaging studies related to mapping pathways for hydrothermal fluid flow. Robert also continues exploratory seismic work as part of his four-year NSF Accomplishment-Based Renewal grant, and with that is investigating magmatic processes along the Eastern Lau Spreading Center and the East Pacific Rise. He is developing methods for three-dimensional seismic imaging of anisotropic earth structure with reflection boundaries - a required technique for examining lower crustal and mantle structure in detail. These techniques are in demand and this year he will host scientists from China and the UK who will visit his lab to learn these tools. In spring semester 2018, he organized a detailed gravity survey of the Manoa Valley and outlying areas to serve as a research experience for undergraduates in his Geophysical Field Methods course (GG450). Teams of students went to the field to collect gravity data, with over 500 points collected during the semester. The students wrote a 55-page report on their study. Graduate student **Charu Lata** continues seismic work on seismic data from the Fiji-Tonga area, and is developing a new technique to gain unique insight into the volcanic structure of oceanic crust. Charu has also taken up the Oahu

gravity survey, and expects to extend the Manoa survey to the broader Ala Wai watershed area. Last year Robert co-lead the REU program's research cruise aboard the R/V *Kilo Moana* to Pa'uwela Ridge. This summer he will again co-lead the REU cruise, the destination being the Kaena submarine volcano. This year Robert expects to carry out a large seismic imaging experiment among the Hawaiian Islands with Donna Shillington of the Lamont-Doherty Earth Observatory. This is part of a broader NSF-funded study that includes UH researchers **Wessel** and **Ito**.

Aly El-Kadi's hydrology group includes a Postdoctoral Fellow, Olkeba Tolessa Leta, and two graduate research assistants, **Chris Shuler** and **Brytne Okuhata**. The research is supported by grants from NOAA, the Honolulu Board of Water Supply, and 'Ike Wai, an NSF's EPSCoR project. Aly is leading the 'Ike Wai hydrological modeling team and also serves as a member of the Leadership Team. Olkeba's research focuses on analyzing the sustainability of watersheds' hydrology and groundwater resources in the Pacific Islands through the use of watershed models. His work is primarily on the watersheds of He'eia, Nu'uaniu, Oahu, and Faga'alu, Tutuila, in American Samoa (AS). His work on Oahu also explored venues for mitigating the effects of climate change by assessing water availability at the Nu'uaniu Reservoir #4 on Oahu. The project is aimed at conserving water by capturing surface water generated in wet areas and its ground injection in a dryer area. Utilizing information obtained from Olkeba's work, Brytne's research is dealing with modeling the response to surface water injections in the aquifer in terms of water quantity and quality. She has also applied electric resistivity as a tool for characterizing the zone where the water will be injected. Brytne's 'Ike Wai's research concerns the west side of the Island of Hawaii dealing with understanding the areas' hydrogeology, compiling the necessary information, and improving on models and their applications. Chris' research is dealing with a number of projects on Tutuila, AS. The projects include developing conceptual subsurface models and exploration

recommendations for Tutuila, assessing near shore contamination by groundwater and surface water, addressing source of contamination in wells, and setting up and maintaining a hydrologic monitoring network on the Island. For his research, Chris has earned the 2018 ARCS Foundation Toby Lee award in Geology and Geophysics. He was also named the Foundation's Scholar of the Year Award, which is significant considering that the competition included winners from astronomy, medicine, chemistry, engineering, and other areas. Congratulations Chris!

Chip Fletcher's Coastal Geology Group had an interesting year. We have started weekly drone surveys (at 6 AM Thursdays if you want to join us) at Kuhio Beach for **Kristian McDonald's** MS thesis. **Haunani Kane** (Ph.D candidate) saw publication of her first dissertation paper (evolution of the Western Samoa coastal plain), and is hard at work processing her drill-core, and trench samples from Bokollop Island, Majuro. First radiocarbon ages indicate a late Holocene age for development of the island. **Shellie Habel** (Ph.D candidate) also published the first paper of her dissertation; a model of groundwater inundation in the Honolulu urban area with rising sea level. Researcher **Dr. Tiffany Anderson** and Geospatial Analyst Matt Barbee saw 3 years of hard work reach fruition with the release of the Hawaii Sea Level Rise Adaptation and Mitigation report by the Hawaii Climate Change Commission. Their modeling of impacts related to sea level rise form the scientific underpinning of the statewide study and GIS maps are accessible via the PacIOOS Hawaii Sea Level Rise Viewer. The Honolulu Climate Change Commission, of which Chip is a member, has recommended that the impact area under 3.2 ft of sea level rise be treated as a special hazard area where all development be either removed to re-engineered to adapt to roughly 1 meter of sea level rise by mid-century. All of their research this year was aided by GES undergraduates **Kammie Tavares** (now an MS student), **Alicia**

Summers, Cuong Tran, and Korey Wong, each of whom use their experience for their BS theses.



PhD candidate Haunani Kane processing cores on the fossil reef atoll platform at Majuro, Republic of the Marshall Islands.

Since the last newsletter, **Neil Frazer** has continued to work on geothermal exploration, under Department of Energy funding, with colleagues **Garrett Ito** (especially), **Steve Martel**, and HIGP colleagues **Nicole Lautze** and **Don Thomas**. Neil's kuleana there is the development of mathematical algorithms that integrate diverse types of data into maps of resource probability and confidence. These algorithms are known collectively as the voter-veto method. Neil also continues to work with HIGP colleague **Rhett Butler** on the probabilities of mega-earthquakes in the global subduction system (currently focused on Cascadia, which many seismologists believe is overdue for a large event), and with Martin Krkošek of the University of Toronto on problems of disease transfer between farmed and wild fish populations. Over the last two years, Neil has also been reinventing his teaching: The focus of his graduate

course, GG695, Bayesian Data Analysis, is now more computational than theoretical, and it emphasizes the computer languages Stan and JAGS, which were created to enable rapid development of Markov Chain Monte Carlo models. This fall will be the first offering of his new course, GG615, Literate Programming, created as an introduction to scientific programming for graduate students and senior undergraduates. (In literate programming, code and narrative are part of the same document – when the code is finished so is the report.) Neil will teach GG615 concurrently with our required undergraduate course GG250, Introduction to Scientific Programming. Both 615 and 250 now include the R computer language as well as Matlab. Either language can be made to do the job of the other, but R has the edge for data analysis, and our students can take it with them when they leave.

Jasper Konter's research has focused on several topics related to the geochemistry and age-dating of hotspot volcanoes. A collaborative project on tracing the Rurutu hotspot through its equivalent of the Hawaii-Emperor Bend is coming to its conclusion (with Koppers at OSU and Jackson at UCSB). We have found that the Hawaiian hotspot appears to be moving with respect to both the Rurutu and Louisville hotspots, while those do not show inter-hotspot motion (published in Nature Communications). In addition, former PhD student, now Postdoc, **Val Finlayson** worked on defining the location of Rurutu's version of the Hawaii-Emperor Bend, and the results are surprisingly consistent with models that explain the bend in the Hawaii-Emperor chain with a significant component of plume motion, while other hotspots experienced far less motion (revised version under review). A different topic that Konter has worked on recently is the general distribution of hotspot geochemical signatures across the Earth's mantle. In collaboration with Jackson (UCSB) and Becker (UT Austin), we have found that early-Earth helium signatures are associated with the hottest hotspots, suggesting only the most buoyant mantle plumes are able to bring this ancient material to the surface

(published in Nature). We have also published on signatures in other isotope systems (lead and neodymium) that suggest that isotopically extreme hotspots are typically associated with seismic signatures that suggest mantle plumes are present in those locations, and a third related paper is in review. In addition to these main topics, Konter continues to work with Chris Kelley and others on exploration of Pacific submarine volcanoes (Okeanos Explorer, Nautilus), including a publication on exploring Samoa's youngest volcano, Vailuluu, and mapping south of Tau island for potential landslide deposits. Konter also continues to participate in the REU program, this year focusing on lava samples from the Okeanos 2016 exploration of the Wake Island national monument.

Steve Martel is busy with three projects: He is working on new methods to better understand the stresses in the Hawaiian volcanoes. He also is applying these methods to help understand fracturing of the bedrock in Sweden and its potential impact on nuclear waste storage there. He also continues work on the structural geology textbook and lab manual he is writing with Dave Pollard.

Greg Moore's marine geophysics group grew in size with the addition of Ph.D. student **Hannah Tilley** and M.S. student **Nina Nakrong**. Both of them joined Greg's cruise in the Fall that deployed several Ocean Bottom Seismographs (OBSs) on the Hawaiian Arch northeast of Oahu; 2nd year graduate student **Jason Lackey** joined a cruise on the Japanese ship, R/V *Kairei*, that shot airgun seismic lines over the OBSs; Nina joined Greg on the OBS recovery cruise and will be working on the data for her M.S. thesis. She is conducting pre-stack depth migrations to better image the Moho reflection in preparation for possible IODP drilling in the future. Greg sailed as a logging specialist on IODP Expedition 372 to the Hikurangi subduction margin over Christmas and New Years and Hannah joined an NSF-funded 3D seismic cruise to the same area in January. Hannah is now working on a high-resolution seismic reflection data set across the toe

of the Nankai subduction zone. She hopes to compare the Nankai proto-thrust zone to a similar structural province in Hikurangi. In the meantime, Jason and Greg continued their study of submarine landsliding along the Nankai margin. Jason's first paper was presented at an international conference on Submarine Landslides in Victoria, Canada, and was accepted for publication in the conference's Special Publication by the Geological Society of London. He submitted his second paper on details of the Nankai slides and contributed to an invited paper on the regional distribution of landslides that Greg submitted for an AGU Memoir.

Brian Popp continues his isotope biogeochemical research focusing on nitrogen cycling in marine environments, marine food web studies and the marine mercury cycle. Joy "Leilei" Shih (Oceanography Ph.D. Student) is completing her dissertation research on the importance of ammonia oxidation associated with sponges on the nitrogen budget of reefs in Kaneohe Bay, Oahu. Joint with Jeffrey Drazen (UH Oceanography), **Cecelia Hannides** (G&G Assistant Researcher), Kanesa Duncan Seraphin (UH Sea Grant Center for Marine Science Education) and Hilary Close (U Miami/RSMAS) we are using amino acid compound specific nitrogen isotope analyses to study the trophic ecology of meso- and bathy-pelagic organisms in the ocean north of Oahu. This group is also using trophic positions derived from isotopic analyses of amino acids to examine methylmercury bioaccumulation in pelagic fishes and zooplankton and, in combination with isotopic analysis of mercury (with Joel Blum, University of Michigan), we hope to better constrain mercury cycling in the ocean. Check your local television schedule for our *Voice of the Sea* documentaries on these two projects. Fieldwork took Brian to the Antarctic in January-February 2018 to study microbial nitrogen cycling. Big news in the laboratory is that **Natalie Wallsgrove** is now the proud mother of Mary Jane Pi'ikea Wallsgrove Cummins born on Earth Day 2018!



Nicole, Val, Haunani, Terry, Max, Shellie, and Kate

Ken Rubin led two research expeditions last year with Schmidt Ocean Institute, one on deglacial sea level archives in drowned coral reefs in Hawaii and the Line Islands, and another on submarine volcanoes in Tonga. Both expeditions used their new ROV *SuBastian* to observe and sample the sea bed, and autonomous underwater vehicles to make very high-resolution sonar maps. The volcanic crisis that began in early May, Kilauea volcano is also keeping Ken busy, with short-lived radioisotope studies of eruptive products and eruption styles, and with massive pressure from the media for interviews (37 mostly live TV spots in 2 weeks). His last year as GG Department Chair was eventful and kept him busy; Ken looks forward to returning to regular faculty life in July 2018.

Thanks to the great science team (**Nicole, Val, Haunani, Terry, Max, Shellie, Kate**) and a photogenic fossil coral specimen on Schmidt Ocean “Sea Level Secrets” expedition FK170825, in the lab on R/V *Falkor*, after ROV dive 63 of their ROV *SuBastian*.

Scott Rowland says: The year flew by, with teaching, a little fieldwork, a little Mars rover work, an excellent IAVCEI conference in August, and some time off with family. Keeping up with Kilauea (or trying to, at least) has been fascinating. In the fall, I taught GG104, 306, and 461, and in the spring, it was GG305, 460 (with Rob Wright), and one section of 101L (we were short $\frac{1}{2}$ a TA position). I must say that teaching the section of GG101L was difficult, but very rewarding. Sitting around big tables looking at and discussing rocks, minerals, maps, etc., or collecting data in the field and graphing/interpreting them with a group of 21 hard-working students – that’s the way learning should happen. I sure hope that at least a few of them see the light and transfer to G&G.

In February, GG graduates **Aaron de Loach** (BS 2010; IODP), **Ryan Hendrix** (BS 2016; Masa Fujioka & Assoc.), and **Samantha Pennington** (BS 2017; Jacobs Engineering Group) took time out of their schedules to come and talk to current undergraduates about what they can expect out in



The Monday section of GG101L and their ancient TA.



Ryan Hendrix, Aaron de Loach, Samantha Pennington (née Burns)

the real world. Mahalo for making the effort to encourage and educate the next generation!

Mahalo also to the GG101L TAs for their hard work this past year: **Rebecca DeGraffenried** (F17), **Daniel Dores** (F17), **Samantha Isgett** (F17), **Elizabeth Benyshek** (S18), **Krista Evans** (S18), and **Warren McKenzie** (S18).

Our newest faculty member, **Tom Shea**, formerly a G&G Asst. Researcher, was recently hired as an Assistant Professor. He is working on examining all facets of the mineral olivine, in particular their capacity to preserve information about subsurface transit and storage of magma, and the timescales associated with magma interactions. During her first year at UH, Tom's first PhD student **Rebecca deGraffenried** has started work on open pockets of melt within minerals that preserve chemical information related to magma ascent rates. His second PhD student **Adrien Mourey** started in Spring 2018 and has already completed series of laboratory experiments involving crystallization of olivine in Kilauea magma to understand how long it takes for large crystals to form. Tom and his students, in collaboration with other VGP members **Julia Hammer**, **Mike Garcia** and **Ken Rubin** are currently dedicating time to investigating the products of the new eruption at

Kilauea under a recently funded NSF RAPID proposal.

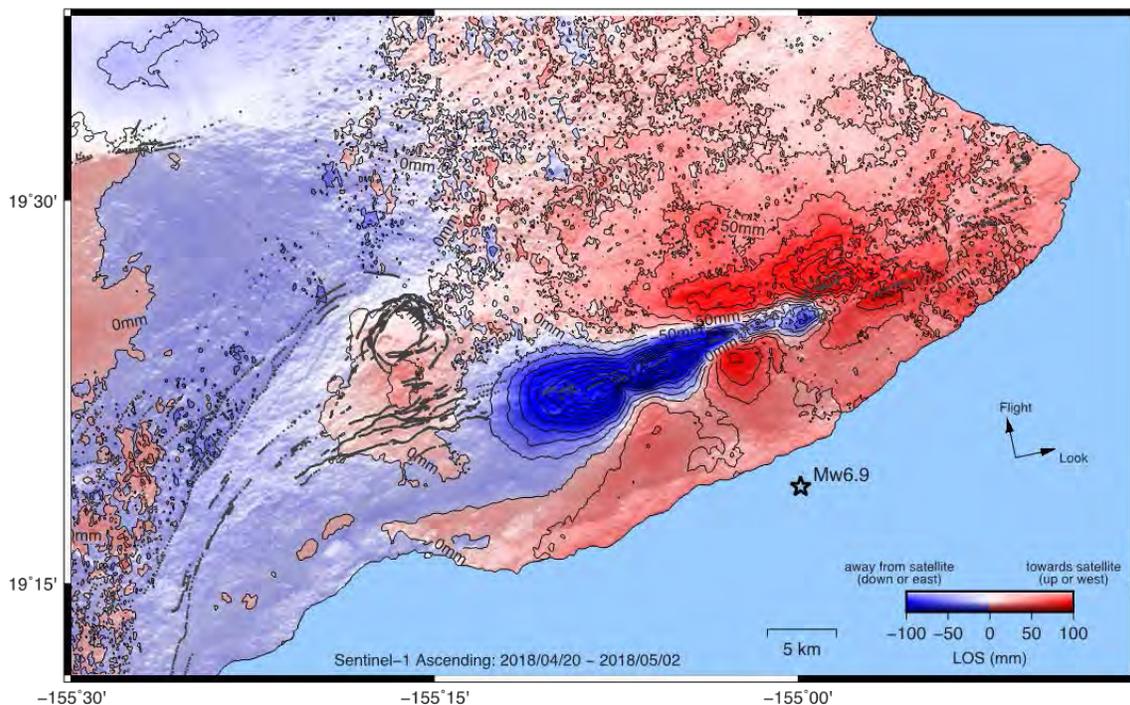
Bridget Smith-Konter and her crustal deformation research group had an exciting and productive year. Congratulations to **Dr. Marissa Cameron**, who successfully defended her Ph.D. dissertation on March 7, 2018, titled *Morphological Mapping and Tidal Stress Modeling of Strike-Slip Faults on Ganymede*. Marissa also presented two invited talks at JPL and the GSA meeting this year, and had one manuscript accepted for publication (*Cameron et al., 2018*) (and one manuscript currently under review) in *Icarus*, focused on tidal stress modeling of Ganymede strike-slip faults. She also appeared on the ThinkTech Hawaii television program to discuss icy moons and planetary exploration. We wish Marissa the very best as she begins a new chapter of her research career in Los Angeles. This year our group also welcomed two new Ph.D. students, **Liliane Burkhard** (returning from UHM/GG) and **Lauren Ward** (from the University of Arizona). Both Lauren and Liliane successfully passed their Qualifying Exam this spring and are on their way to studying deformation of the San Andreas Fault System and tidal stresses of icy moons. Additional congratulations go out to Lauren for receiving a NASA Goddard summer research internship. We also welcomed GG undergraduate

student **Justin Higa** to our research group, who helped test numerical models of fault deformation subjected to rigidity variations. Together, our group attended three international meetings (Southern California Earthquake Center Annual Meeting, GSA, AGU) with 7 submitted abstracts. We also published four papers, in topics ranging from the study of stress from topography and earthquake focal mechanisms in California (*Luttrell and Smith-Konter, 2017*), advances in crustal deformation computational modeling (*Sandwell and Smith-Konter, 2018*), and even interactive sonar mapping for educational audiences (*Boston et al., 2018*). We are also working on a new study with colleagues from Scripps Institution of Oceanography to study variations in creep rate along the San Andreas Fault System due to Coulomb stress changes from large regional earthquakes (*Xu et al., in prep*).

In response to the 2018 Kilauea eruption and M6.9 Leilani Estates earthquake (**see figure below**), our group has been very busy processing InSAR data

from the Sentinel-1 mission. New radar data are acquired every 3 days, and we are providing phase change and line-of-sight maps of the eruption in near-real time (http://pgf.soest.hawaii.edu/Kilauea_insar).

On the educational front, Bridget focused most of her time teaching UH undergraduates, offering introductory courses GG105 (*Voyage Through the Solar System*) and GG101 online (*Dynamic Earth*). Also this year, our group participated in several major education and outreach events, and also made special visits to local classrooms upon invitation. These events include participation in the SOEST Open House (6,800 visitors), the Hawaii STEM Expo (5,000 visitors), the Manoa Experience (2,000 visitors), Hawaii P-20 Middle School Career Fair (700 visitors), and the Kapiolani Community College STEM Pai’ina (~40 visitors). We also visited Waialae Elementary (92 participants) and Hawaii Baptist Academy (84 participants) to bring Earth science demonstrations to local classrooms. Bridget also led



Preliminary observations from the 2018 Kilauea eruption event spanning the initial May 1st dike intrusion that extended from Pu’u ‘Ō’ō to the Leilani Estates region. Colors represent line-of-sight ground motions observed by Sentinel-1 radar data, capturing the differential, predominantly vertical, response of deformation caused by the newly intruded dike into the lower rift zone, and deflation of the active portion uplift of Pu’u ‘Ō’ō.

the UH effort to participate in the *Great Hawaiian ShakeOut* earthquake preparedness event in October (in conjunction with the international *Great ShakeOut* event), which has grown to include over 300 UH students, faculty, and staff.

Paul Wessel has spent the last year writing several GMT-related proposals (and non-GMT proposals as well) and continuing to supervise his student **Elizabeth Benyshek** on deciphering the tectonic evolution of the Ellice Basin between the massive oceanic plateaus Ontong Java and Manihiki. We are lucky to rely on the marine tectonics experience of our dean **Brian Taylor**. This pilot project is a clear case of a reconnaissance expedition leading to more answers than questions, which of course is a good thing in the long run. This summer will see a visit by Ellice collaborator **Michael Chandler**, my former student and now a post-doctoral researcher at KIOST in South Korea, and we will continue to work on geopotential and sub-

bottom profiler data collected during the Ellice cruise. Wessel continues to work with his post-doc Leo Uieda on the Python interface to GMT 6; to get a flavor of what is in store you can click on www.gmtpython.xyz and try it out in a browser. Much of Wessel’s effort now goes into GMT 6 which will introduce a new “modern” mode to GMT user – greatly simplifying how the software is used to make maps and especially animations. The modern mode will be the foundation for the Python interface, while the classic mode remains for backwards compatibility. We are also preparing a series of workshops with the core GMT team to plan for the inevitable transition of GMT leadership. With Wessel taking over as the GG Chair on July 1 there will be no rest for the weary in 2018 either. Oh, and he is again leading the department’s NSF-funded Research Experience for Undergraduates site program this summer, with 11 students and two embedded documentarians running wild.



*Alexandra, Kaelan, Annika, Kelsey, Katherine, Manlio, Otto, Alexander, Kelsey, Mary, Letrell
2018 GG REU cohort and Alexandra (left end) is an adopted NASA-funded PGGURP participant*

* * *

Distinguished Alumnus

Michael Dahilig (BS 2003 in Geology & Geophysics)

Director of the County of Kauaʻi Planning Department



It seems like yesterday I roamed the halls of the POST building at 1:00 am in a daze because Matlab kept giving me the same stupid error over and over again as I crammed for an assignment due to Steve Martel later that morning. It may have driven me

nuts at the time but, I admit, I now look back fondly at those moments and my overall college experience in the Geology and Geophysics department. My time there was foundational to why I think the way I do today. It helped build my character, gave me opportunities in life, and budded lasting relationships for which I am grateful.

I've been blessed the past eight years to serve as Director of the County of Kauaʻi Planning Department. I never would have imagined I would be doing what I do, including the level of responsibility I would carry, particularly when it comes to the future of this island and the livelihood of its people. Those who cross my line of work, and know I'm also an attorney by training, often ask what I majored in during undergrad, and are often first shocked at my response, but then reply, "Ok, that makes a lot of sense."

When I graduated from G&G back in 2003 and was heading to the Richardson Law School, I thought I was saying aloha to many of my classmates and professors because my educational pursuits were about to take me down a left turn, away from the science world. I now warmly chuckle at the fact that I still in fact keep in close contact with G&G classmates of mine, including guys like Chris Conger at Sea Engineering and Jeremy Kimura

at the Commission on Water Resource Management. I also never thought I'd be applying Chip Fletcher's science and molding erosion-based shoreline setback regulations in our county. In some ways it can be said that science never really leaves you once you touch it.

Although my academic pursuits with G&G stopped at the baccalaureate level, having working knowledge based on a hard-science background has truly augmented my work on Kauaʻi. Planning is the crossroads where many disciplines converge, including where social science often intersects with hard science. Having the opportunity to work in an inter-disciplinary role with a foundational background from G&G has served me well.

I am fortunate to have an awesome staff here at Kauaʻi Planning, and when I look back on the work we've done – items like: having science-based shoreline setbacks that lead to probably one of the most progressive coastal development protection policies in the nation; working with UH Sea Grant toward integrating sea level rise and emphasizing retreat development policies into our 2035 general plan update; meeting state renewable energy targets fifteen years ahead of schedule through the largest solar plus battery storage facilities in the world and free-flow hydroelectric; and greater emphasizing hazard avoidance in our spatial development patterns – those needle movements toward finding better balance with our environment come from the "educational DNA" during my years at the Department. I firmly believe Kauaʻi is well positioned ahead of the state to face the challenges posed to us by climate change and population growth in the coming years.

Having served on the UH Board of Regents for eight years, I grew in my appreciation of the role

higher education plays in building a democracy and growing vibrant communities. I am thankful for the rigorous instruction I received while at G&G -- the intimacy with the research and teaching faculty, along with the resources available to me as an undergraduate, are a unique and special find throughout the ten-campus UH System.

I would hardly consider my life work to this point distinguished, but I am flattered that my alma mater with such a rich academic tradition would even consider putting forward for recognition a kid

who could barely pass mineralogy. Sometimes, I drift back and wish I could be out there again in the Mojave desert with Scott Rowland and my classmates on the back porches of the Royal Hawaiian Motel, sipping beers and laughing about the day's field work. Just as much as the science, G&G was also about the relationships and I smile knowing it is a part of my roots. Whenever I have had the opportunity to share, I love to mention I'm a product of G&G. I'm glad to know now the feeling is mutual. My sincerest mahalo.



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Alumni News

Bruce Appelgate (Ph.D 1995): I direct Ship Operations & Marine Technical Support at Scripps. It's a great job. We operate the research vessels Roger Revelle, Sally Ride, and Robert Gordon Sproul, and the research platform FLIP. Research vessels have played a critical role in the exploration and understanding of our planet and contribute significantly to the broad spectrum of U.S. ocean research interests. Even with the advent of remote and autonomous observing platforms, research vessels are (and will continue to be) essential for the observation, measurement, and collection of samples and data on a global scale. At Scripps, I'm proud to be able to help maintain a part of the U.S. academic research fleet that capably meets the needs of current and future scientists. And, as Roger Revelle said, "Oceanography is fun".



The Appelgate family: Eli, Alison, Bruce and Lisa. Montana De Oro state park, 2018.

David Blewett (MS 1994, Ph.D 1997) and **Gina Ling** (Ph.D 1996) live in Laurel, Md., where they have been on the staff of the Johns Hopkins University Applied Physics Lab since 2007. Dave (<http://civspace.jhuapl.edu/Our-Staff/>) was a Participating Scientist on the now-completed MESSENGER mission to Mercury and Dawn mission to Vesta. He continues to conduct research into the geology of the Moon and other airless solar system

bodies. Earlier this year, he led the effort to have a lunar crater named in honor of his master's and doctoral advisor B. Ray Hawke. Dave is happy to have APL planetary science co-workers with UH connections – G&G grads **Josh Cahill**, **Brett Denevi**, and **Karl Hibbitts**, and former HIGP post-doc **Jeff Johnson**. Dave and Jeff occasionally get out to see a band (the Cure, Echo & the Bunnymen, New Order, Trashcan Sinatras, Squeeze, English Beat, OMD, Kraftwerk).

Gina is an engineer working on defense-related projects at APL. She spends a good deal of her free time running the Gina Ling Chinese Dance Chamber, teaching Chinese classical, folk and modern dance to children. She is the group's teacher, artistic director, choreographer, publicist, and manager. Gina's choreography and the dancers have won many awards in dance competitions, and the group often performs at events in the local community. The photo shows Gina on stage after a performance by her dance students in 2016.



Gina, 2016

Their son Derek graduated from Mid-Pacific Institute, Dave's alma mater the University of Pennsylvania (BSEE), and Stanford University (MSEE) and is employed in Silicon Valley in the field of robotics and computer vision.

Michael Chandler (BS 1998, MS 2006, Ph.D 2011) reports that he returned to SOEST for the

summer to continue with Ellice Basin research. For the past couple of years he has been working at KIOST, in Korea, and plans to apply there again after his work at UH is finished. He hopes to return to UH periodically to continue working with his excellent colleagues in the GG department.

Emily Chapp Morale (MS 2006): My family and I moved to Houston last year after finishing a 4 year assignment in Sumatra, Indonesia. I've been working for Chevron for the last 12 years drilling oil and gas wells, and I'm currently in an Advisor role for our North America Planning Group analyzing and forecasting activity and spend in the Gulf of Mexico deep water and North America shale plays, including the Permian, Appalachian and Duvernay Basins. In addition to my planning job, I'm involved with several groups to promote inclusivity, diversity and advancement of women within Chevron. Our kids Brady (5 years old) and Violet (3 years old) have transitioned to life in the U.S. after spending their first years overseas, and we're all excited to have our first kindergartener in "the big kid school" next fall.



Violet (3), Brady (5)

Patrick Gasda (Ph.D 2014) says: I'm now a staff scientist at LANL. I'm also continuing to participate on the MSL mission for the foreseeable future.

Sarah Glancy (MS 2014): I don't really have anything new to report. I'm still teaching at West Oahu. I don't have any classes this summer, but I'll be leading a discussion session on professional development for adjuncts at the Earth Science Educator's Rendezvous and presenting a couple of activities. Fingers crossed that it all goes well.

Denise Hills reports: Things are, as usual, incredibly busy. Seems like **Andy Goodliffe** (Ph.D 1998) and I trade off travel, although his tends to be to far more interesting places than mine. Not sure the last time we sent an update, but he's now full-time administration, having been promoted to Associate Dean for Graduate Admissions, Recruitment, and Fellowships last year around this time. In the past year he's been to China, India, Thailand, and I'm not sure where else, doing graduate school recruitment. He still advises a few students in the UA Department of Geological Sciences, and still gets to attend some geoscience meetings (such as AGU). He misses doing research, but he really enjoys (and is very, very good at) enabling others to do their research.

I'm still Director of Energy Investigations at the Geological Survey of Alabama (GSA), where my research is primarily on carbon capture, utilization, and storage (CCUS), focused on the geological storage of CO₂. If you want a laugh, check out my AGU talk from this past meeting in the Up-Goer 5 session – "**Is under the ground under the big blue water named for the land next to us good for putting away bad air?**" – my talk starts at about 1:26:00, but the whole session is very entertaining.

Our group also maintains the GSA's geological core and sample repository, trying to get everything we can captured digitally so that people can find out that we have it. It's slow going, but we're making progress. I'm now past-chair of the Geological

Society of America's Geoinformatics Division, and I start my term as President of the Earth Space Science Informatics section of AGU on Jan. 1 (I'm currently president-elect). I'm also getting more involved in policy work, primarily through AGU, where I serve on the Policy Statement Committee. I also was selected as a participant in an AGU-sponsored congressional visits day, and am an inaugural member of AGU's Voices for Science program, which is a year-long program all about training scientists to be better communicators about the value and impact of Earth and space science to key decision makers, journalists, and public audiences. Here's an Eos piece about my participation in a [Congressional Visits Day](#) and a [From the Prow](#) post about the Voices for Science program.

Kieran just wrapped up his first year of high school and is on track to start college a bit ahead in math and science, good for his ambition of being either an aerospace or explosives engineer. He's rapidly approaching Andy's height, which thrills him and annoys Andy. Ginny starts 6th grade in the fall and is passionate about computer games and taking care of animals. They're both volunteering part time out at a local farm, where they also taking horse riding lessons and help out with farm chores, lessons, and camps for folks with special needs. It keeps them busy and appreciative of the value of hard work.

We've been following the ongoing eruption on the Big Island and are so impressed with all the UH folks who are doing the hard work and explaining it clearly to everyone. The kids are really interested as well, especially as we had stayed in Volcano this past December and had seen the lava lake in Halema'uma'u and took a helicopter flight over Pu'u 'Ō'ō. We hope to be back in the islands again this winter break, but if not this year, we'll be there soon.

Toshihiro Ike (Ph.D 2007) works for the Japan Oil, Gas and Metals National Corporation (JOGMEC)

in Tokyo/Japan. JOGMEC is in charge of securing a stable supply of oil, natural gas, nonferrous metal, mineral resources coming to Japan. He currently work for the project department in Geology & Geophysics division where he runs projects involving geological risk assessment and petroleum reserves estimation. A recent standout project was a survey in the ocean off Russia's Far East. Toshi still lives in Chiba, Japan with his wife and two children. They spend some of their leisure time driving around Tokyo (before the 2020 Tokyo Olympic) and taking photos.



Toshi, Kazuki, Misaki and Tomoko

Samatha Jacob (MS 2015): After a 3-year hiatus from academia, I have accepted a PhD position at Arizona State University. I am working with GG alum **Dr. Jim Bell** and will be continuing my involvement with the Mars Science Laboratory Curiosity rover science team. My research will mostly utilize the multispectral data from the Mastcam camera onboard the rover. I am excited to see what the desert has in store for my career as a planetary scientist. Another exciting moment this year was on May 19th, when I was the maid of honor in **Dr. Kendra Lynn** and **Isaac Ishihara's** wedding, both of whom are GG alums as well. It was a great honor to be there to celebrate their marriage. The SOEST and GG department not only gave me a great education as the foundation for my future, but also introduced me to some of my best friends. Aloha from Mars!

Jacque Kelly (PhD 2012): I am pleased to announce that I have received tenure and promotion to associate professor of geology at Georgia Southern University. Patrick and I have three beautiful children and enjoy living in Georgia.

Amy Kitchner (BA 2016): After graduating in 2016, I got a year-long internship at Kupu, interning with Natural Area Reserves. I earned many certifications and valuable skills that led me to land my current job as a watershed protection support technician with Waianae Mountain Watershed Partnership. My first year after graduating was grueling working two jobs with little pay, and no time off. Now I've been enjoying my free time such as traveling to Japan, Coachella, learning basic Japanese, and walking my down syndrome cat. If you like to hike on Oahu, don't be surprised if you find me cruising in the mountains.



Amy Kitchner

Stephen Leslie (MS 2001) recently started a new position in Houston at Repsol (an integrated global energy company based in Madrid, Spain). He is working on the Mexican offshore area, a big salt province with lots of interesting geology and the chance to drill some meaningful exploration wells.

Kendra Lynn (MS 2015, Ph.D 2017) and **Isaac Ishihara** (BS 2013) (G&G Department sweethearts!) got married in May and have been halfway around the world on our honeymoon. They saw almost

every volcano in southern Italy from the historic Vesuvius and Etna to the iconic Stromboli and Vulcano. Seeing the dependable, "gentle" explosions of Stromboli was amazing, especially in the context that the volcano is the namesake for that type of activity. The European portion of the trip wrapped up in Rome where we saw some amazing historical sites and just like in Mike Garcia's building stone lab from petrology, we noted every type of granite, marble and tuff in the building materials of Catholic churches and Roman ruins alike. Then they got on a plane and flew halfway around the world to celebrate with friends and family in Hawaii. It was great to be back.

On the job front, Isaac recently got a position with an environmental consulting firm that does everything from lead and asbestos work to geotechnical to NEPA historical and archeological projects for telecom companies. They're called Acer Associates (and they don't make computers) from West Berlin, New Jersey. They do work up and down the east coast from New York to Virginia, though they are a small company (about 20 of us).

Kendra continues her work at the University of Delaware and as a research associate at the Smithsonian National Museum of Natural History in Washington DC. She continues to travel a lot, with research opportunities at Harvard, Argonne National Lab near Chicago and at Washington U in St Louis. Her focus is currently oxygen fugacity recorded by MORB and abyssal peridotites, diffusion during melt rock interactions, and diffusion at lower temperatures during hydrothermal alteration.

Melissa Rotella (MS 2008): Simon and I welcomed our second daughter, Emily Christine Barker, on 20 November 2017 (Isla Rose Barker was born in March 2016 and we got married in January 2017 in the snow in Canada). We are in Auckland but are moving to Wellington in July. I'm currently on maternity leave but have been working in Research Management at U. Auckland. I hope everyone in

Hawaii is doing well, please pass along my hellos. It's pretty exciting seeing Kilauea erupt as it has been. I've been following your facebook posts and those from the USGS. It has been covered very well in social media.



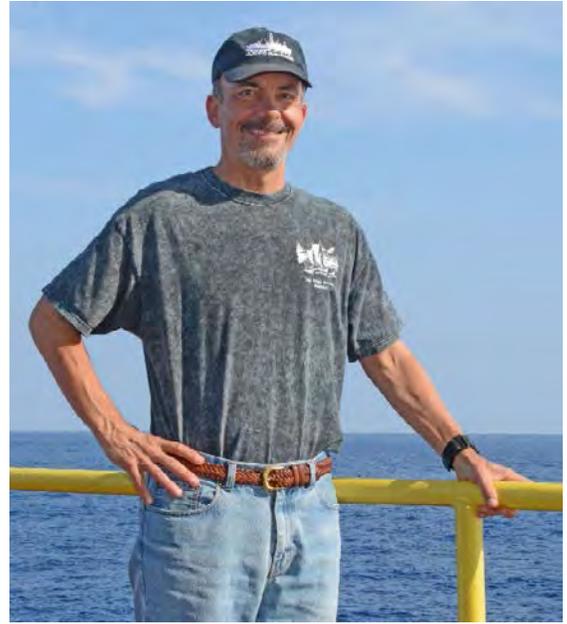
Melissa & Simon



Melissa, Isla Rose, Emily Christine, & Simon

William Sager (MS 1979, Ph.D 1983, 2012 Distinguished Alumnus) can still be found in Texas, but wearing a different color hat. After working in the Department of Oceanography at Texas A&M University for 29 years, Will moved to the University of Houston in 2013, where he is a professor in the Department of Earth and Atmospheric Sciences. "I'm back at UH", he said, "but the hat is red instead of green". Sager continues his research in marine geology and geophysics, especially focusing on oceanic plateaus and hotspots. "I'm working on publishing a new magnetic anomaly map over Shatsky Rise. The

astounding thing is that the anomalies are all linear, implying that the whole thing - including the enormous Tamu Massif volcano - formed by spreading". He continues to collect data at sea with cruises to Rio Grande Rise this year, Walvis Ridge next year, and an IODP expedition in 2020.



Will Sager

Lindsey Spencer (BA 2012): For the past two years I have been a stay-at-home mom taking care of my son, Sebastian (Bash). A little geologist in his



Lindsey and Bash

own right, he loves to be outside, explore, and play with rocks. I have also been fortunate enough to work on some projects with Hawai'i Pacific Health regarding cancer awareness, specifically ovarian

cancer. In May of 2014, I was diagnosed with stage 1C ovarian cancer. Over the course of four months I underwent surgery and four cycles of chemotherapy treatment, and am proud to say that I have been cancer-free since September of that same year. As someone who knew nothing about the disease prior to my own experience, spreading awareness about ovarian cancer has become one of my main life goals over the last few years. In 2016, I worked with the Hawai'i Pacific Health marketing staff to tell my story that was featured in a campaign highlighting survivors of all types of cancers. Last year, I was chosen and honored as a member of the Wall of Hope at the Kapiolani Medical Center for Women & Children. The Wall of Hope is a photo exhibit in the hospital that highlights former patients who have experienced and survived significant medical conditions, and serves to provide hope and inspiration to current patients and hospital staff. Lastly, in April of this year, I was chosen as Hawai'i Pacific Health's Beautiful Survivor, and featured on KITV Island News where I shared my story to spread awareness about the disease. With cancer behind me, I plan on going back to school this fall as a first

step in working toward a career in the medical sciences.

Ben (MS 2007) and **Melody** (BS 2004, MS 2007) **Studer** are enjoying life in Eagle, Idaho with their 3 children (Malia-10, Logan-8, and Lily-8 months). Ben



Studer kids



Lindsey being honored as a member of the Wall of Hope

continues work at the Idaho Fish and Game Headquarters. Melody works part-time for Alta Science and Engineering, Inc as a Licensed Geologist and Project Manager. Melody's work largely involves site assessment including remedial strategies such as groundwater monitoring well installation, underground storage tank removals, soil and groundwater sampling, soil vapor extraction systems, etc. Both Ben and Melody enjoy flexible schedules as they balance their time between work and family life.

Mike Theune (BS 2007) continues to work as a fire information officer based out of Sequoia and Kings Canyon National Parks. This past winter he did a fourth month assignment at the National Interagency Fire Center in Boise, ID as a national spokesperson for the NPS. Recently, Mike did an assignment as the lead public information officer for the closure and response in Hawai'i Volcanoes

National Park related to the Kilauea summit eruption because of his educational background at UH and his experience working on complex national-level incidents. In the summer of 2018, he will be presenting at the Ecological Society of America's national conference on techniques bringing ecology into the wildfire conversation.



Mike Theune

Jonathan Weiss (MS 2004; PhD 2016) and Julia Ehses (Aachen University exchange student 2004/2005), and their two sons Onno (blue & red jacket) and Koa (light blue) are enjoying their time in



Julia, Onno, Koa, & Jonathan

Leeds UK. Jonathan has been a post-doctoral fellow at the University of Leeds since 2016.

Rob Yonover (Ph.D 1989) displayed his military-approved/adopted lifesaving technology on ABC Shark Tank:

<https://drive.google.com/file/d/0B21GpRL-tAKnekdkbHNISmlZbTQ/view?usp=sharing>

The patented *SeeRescueStreamer* emergency locating device is used worldwide, including onboard F-16 and F-35 fighter jets, and has already saved four lives!

Elizabeth Zbinden (MS 1984): I continue as an independent consulting geologist in the mineral exploration field. My project for the summer is at Round Mountain Mine in central Nevada, helping them find gold to mine in five or so years' time. The mine is coming up on a milestone of 15 million ounces produced, anticipated for some time this fall. Yesterday we had a review of some of the pieces that go into that 15 million ounce. For example, the last time I was here at Round Mountain we were developing a satellite deposit called Gold Hill (this place is not known for great originality in naming things). As of now, they have been mining Gold Hill for five years and have produced 250,000 ounces from it. That's a lot of work and sounds like a lot of gold-- until it is explained that the 250,000 ounces would fit into a cube only 29 inches on a side.

Zhiyong Zhao (Ph.D 1998) says: My house was flooded during Hurricane Harvey last year. The damage was pretty severe, so we are still recovering. Everything less than 4 feet above the floor had to go except for the wall frame. Because there has been such high demand for house repair, it has been difficult to hire a good contractor to have a timely repair. We started to do some small and simple repairs by ourselves such as change electricity plugs, but gradually we have been getting more confidence and doing much more than we had ever thought we could. So far, we have repaired walls and windows, replaced all the doors, and

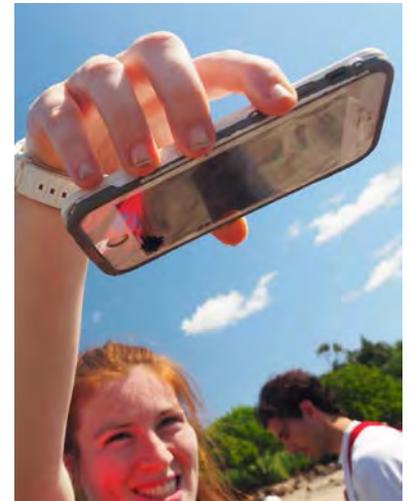
restored the kitchen. Although there are still much more to be done, the house is looking like a home now. By the way, we are not too much behind some of our neighbors, who hired a contractor to do these

jobs. My daughter Kelly opened her dental office two years ago. She works very hard and is getting more patients.

* * *



GG104, 101, and 101L students at Waimea Canyon, Kaua'i, Fall 2017.



Playing with magnetite and a cell phone, Glass beach, Kaua'i.



GG101, 101L, and 104 ready to bike out to the ocean entry, Fall 2017.



Ready to hike to lava, Spring 2018



GG101L streamflow measurements, Mānoa.



Improving campus with a geologic timeline.



Learning about rocks, birds, and plants, GG101L + BOT 450 at Ka'ena Pt.



GG104 students gathering pōhaku for their final projects (on display near the elevators in POST).



The final result of lots of careful stone-on-stone pounding.



GG101L students preparing the mud for planting kalo.



GG 101L students making streamflow observations and measurements at Waipao.



GG101L students making a geologic map at Lē'ahi.



GG101L students quantifying dramatic (not) shoreline-profile changes at Wai'alae beach park.



The first day of GG305 mapping at Hanauma Bay, trying to decipher subtle differences in tuff layers and dealing with sun, wind, rain, which pocket to put your pencils, protractor, Brunton, and GPS in, running out of water, etc...



The Mojave was cold and windy this year.



Celebrating the end of GG305 work with a traditional leap at Badwater, Death Valley.



A view across the Armagosa Valley from our Mojave field area.



GG306 students studying a Hawaiian stream.



GG306 students making streamflow measurements.



GG306 students studying Darcy's law.



The spots on the skyline are the GG460 students.



GG460 students (and Rob Wright) ready to start ground-truthing their final-project maps.



SO₂ in the GG460 field area (and now the place is coated with ash; photo by Eric Welch).

Donation

Remember when...

You held your first rock specimen in a GG class or took your first GG field trip?

You made your first map, learned about a useful isotope, or looked at a seismogram?

The GG department became your academic home, a place of learning with friends and colleagues?

Help others have that experience with a gift to the GG department. Your donation will maintain and replace aging teaching infrastructure, support field excursions, and provide modern computing and audiovisual equipment for our classrooms and computer lab.

Please contribute to the GG department fund at the University of Hawai'i Foundation and help make those *geo-dreams* come true for a new group of emerging geoscientists. Consider making a gift today through the UH Foundation website (<https://giving.uhfoundation.org/give/giving-gift.aspx?allocation=12077204>) or click the "donate" button on the GG home page. *Thank You!*