

# VKØEK Heard Island 2016

## Part 5 – CHANGE: Disappearing Glaciers, New Islands, and Debris

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with Fred Belton, Gavin Marshall, Eric Woehler, and Grahame Budd

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*Gavin Marshall's Log 05:25 AM 5 April 2016. We can see Big Ben from top to bottom. What a fantastic mountain, and much bigger and ominous than I had anticipated. Very steep sections of ice and many blue ice glaciers tumbling down from the flanks. Severe crevasse fields!*

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### An Extreme Place for Radios

It is about 15 years since the previous scientific expedition. Lots could, and did, change. The most obvious change on the planet is the change of climate, and it's well-known that subantarctic islands, like and including Heard Island, will be driven to change in major ways. Lava will flow, glaciers will melt, and the flotsam from a messy world will float all around, fouling the water and the land and the plants and animals. What could we have predicted at Heard Island, and what did we find? And what does it have to do with amateur radio and DXing?

Let me answer the last question first: It was DXing that enabled a visit to this remote island, and the opportunity to document the changes. It would have been irresponsible if, as one person suggested, we do nothing but work pileups. One DXer wrote angrily about the idleness of the expedition: "Every picture

they take costs 2 QSOs. Are they there to log QSOs or take pictures?" Sorry—we disagree with this DXer; we feel that every such minute means two images of the environment captured, a gift that will continue to be of value well after the QSO numbers are forgotten.

So to the expedition: With the limited time and mobility under the permit, photodocumentation was our main tool for documenting the change. We raised about 15% of the financial support from non-radio sources, and devoted about 15% to manpower and time in the field. We returned with 25,000 photographs, which we consider data rather than postcard pictures. We are able to make meaningful comparisons with historical photographs, and to provide a database for future comparisons.

Here are some of the observations and discoveries we made:

- The elevation of the summit of the volcano has risen 45m in the past 19 years
- A tiny islet supporting a colony of nesting cormorants was documented as having no birds
- Surf has cut through the isthmus connecting a peninsula on the northwest tip of Heard Island
- A large colony of spiders was found living in a refuge shelter
- Freeze-thaw cycles have cleaved thousands of boulders into flat plates
- The 1947 research station at Atlas Cove is almost totally destroyed
- Plastic debris litter the coast, concentrated in certain places
- In one location apparently an entire pod of dolphins was beached and died
- The population of Heard Island Cormorants has jumped from 200 in 1997 to 2000 in 2016
- Detailed measurements of the wind showed that vortex formation is widespread
- Water from glacial streams is slightly acidic
- Numerous glaciers have retreated significantly, and one has melted to form a 2-mile wide lagoon
- Two coastal breakwaters have been almost totally destroyed recently by surf action
- Hundreds of streams issue from below glaciers and flow into lagoons or the ocean
- Hundreds of ice slumps show that the termini of major glaciers are experiencing major retreat.

The net result of these observations, and numerous others, provides strong evidence of the inexorable changes being driven by the climate. Regardless of the cause, the climate is clearly changing, and places like Heard Island are being changed extensively. It took 19

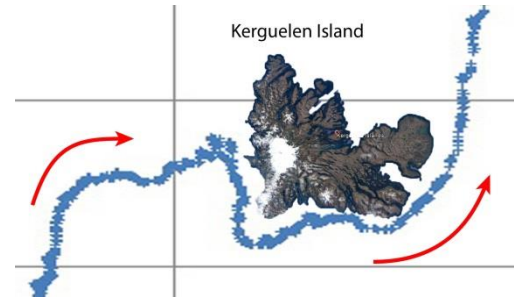
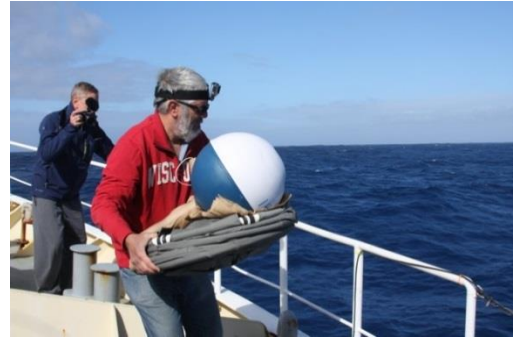
years for a DXpedition to return to Heard Island. When someone returns for the next one, it's sure that they won't find the same island that we experienced, and it would be good to have a few environmental scientists on the team. Frankly, I'd like to go again!

## Discovering the Subantarctic

We present here just a few of the many observations that we made on this expedition. To start, we note that on the voyage from Cape Town to Heard Island we were able to deploy 10 drifting and diving buoys for NOAA and WHOI. The buoys drifted north eastward with the wind and currents, periodically telemetering their multi-parameter environmental data. Interestingly, one buoy approached the Kerguelen Islands head-on, but went around it to the south. Perhaps the deflected flow also works to prevent flotsam from fouling the shores on Heard Island.

Evidently this process isn't perfect: we found a large number of items, large and small, that had floated in and remained, including numerous large (ca 1m) marine fenders.

A natural source of debris is frost-shattered rocks, which littered the ground near our campsite. The rock is broken into plates which eventually fall over to form a tessellating pavement. Interestingly, the separation doesn't stop there: even after the plates are free, the freeze-thaw cycle in the gravel pushes them ever farther apart.



Creatures from very large to very small live on Heard Island, including a small one, the wingless fly *Anatalanta aptera*. There are four species of flies on Heard Island, and all of them are wingless. Long ago they found that if they jumped up and tried to fly, the wind would quickly dump them in the ocean. Only flies that were deficient in the wing department would tumble back to land. Probably only a few thousand generations were enough to reduce the wings to vestiges, utterly incapable of sustaining flight. So they crawl like ants.



A larger creature is represented by the mysterious skeleton shown here, which we estimate was 2-3 ft. long when alive. While it looks for the world like a "missing link", the author believes it was a penguin.





Near the northernmost part of Heard Island, we discovered a tiny islet, about 40m x 120m. The islet shows some mysterious structures on its top surface: they are cylindrical, about 1 m high and 1 m diameter, spaced in a nearly regular array 2-3m apart. These could be classic expressions of hexagonal jointing, a common structure in volcanic rocks, but in fact they are the nests of blue-eyed cormorants, who construct them with their droppings. The birds leave their nests in April, as this picture confirms.



Just to the north of the islet, we found that the pounding surf had breached the isthmus that connected Laurens Peninsula with a knob called (incorrectly) Red Island. This apparently happened in the last two years. Two channels were opened into the former freshwater lagoon: a wide one on the west and a narrow one on the east, now making Red Island a real island. We found that similar changes are happening in many places on Heard Island: areas that were created and connected by low-lying land, often weakly consolidated volcanic till, are being demolished by the combined erosive actions of increased glacial runoff and the constant consumption of the shore by the violent surf, driven by the winds. As the atmosphere warms, these processes operate faster, so the destruction of the geo- and glacio-structures accelerates, and the ecosystem is increasingly altered. Our observations provide evidence of this.



*Two straight cuts made in the last two years have severed the isthmus, flooding the lagoon with seawater and detaching Red Island. This particular change probably won't affect the birds, which don't depend on a land bridge, but it undoubtedly changed the fauna in the lagoon.*

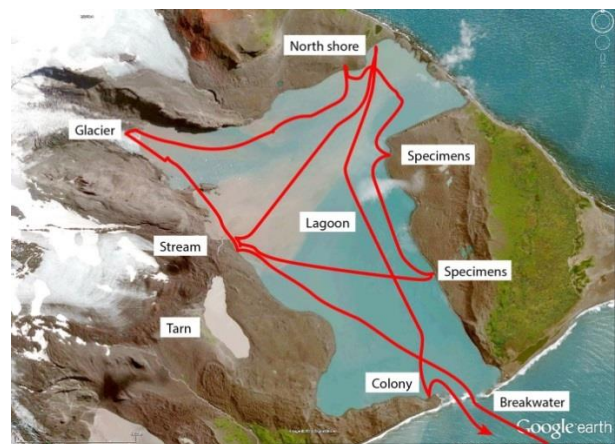
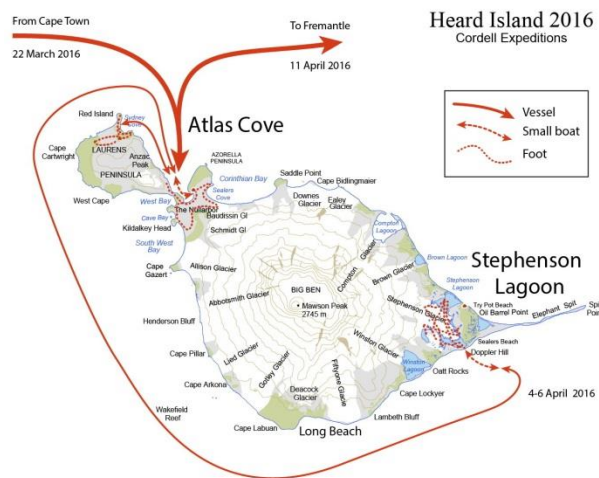




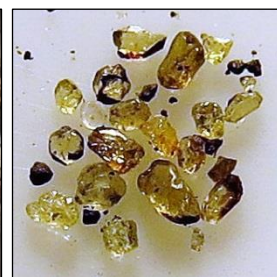
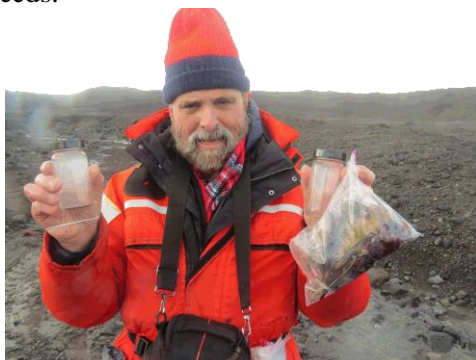
**AudioLog 9:41 AM 5 April 2016** At anchor off Stephenson Lagoon. Wind is 20+ knots, whitecaps. A spectacular sight, the morning sun shining on the southeast side of Big Ben. Loading the boat for the first (ever) entry into Stephenson Lagoon. Gavin Marshall, Fred Belton, and myself, together with the boat's crew. Going to be gone a couple hours—a date with a brand-new lagoon, only 10 years old and 2 miles across...

## Exploring a Brand-New Lagoon

In satellite images from 2014, we discovered many interesting geophysical features associated with a lagoon created only 10 years ago by the melting of a large glacier. The lagoon is on the opposite side of Heard Island from our main camp, about 20 miles distant. It is 2 miles across, apparently protected by wide breakwaters on the north and south. During 3 days, we had an opportunity to make the first (ever) entrance into the lagoon, document the fascinating glacial structures around it, and collect samples of the sediment and water for later analysis. We had only 3 hours on one day, but zig-zagged across the lagoon, stopping at various shores for specimen collection, and taking photographs continuously. The GPS recorded our positions to within a few feet. Among other observations, we found that both breakwaters were almost totally destroyed in only 2 years.



Among the amazing features we documented were hundreds of huge ice slumps, steep escarpments where the glacial termini were falling away, and their gravel overburden was sliding down the slopes. Gravel in sizes from boulders to microscopic grains was everywhere. We collected scoops of it, and later sorted it into sizes using a set of calibrated sieves. The material retained by each sieve showed both consistency and diversity, and some of it contained amber crystals, likely olivine. There were also tiny plants, and many items like pollen or seeds.



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**AudioLog 5 April 2016. Off Stephenson Lagoon.** *While we were in the lagoon we were able to go over to Spit Bay shore where we had considered a radio operation. Observing it from two vantage points it was clear there was no option whatsoever of approaching the area to set up a radio operation. Furthermore, Braveheart crew determined that the anchorage and the surf on the north coast of Spit Bay, on the outside, was unworkable, and as we were doing this the weather started to close in, so we had to complete our observations and get out of there.*

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### **DXpeditions in the Extreme**

After months of thinking that we could occupy the shelters at Spit Bay in order to avoid the potential blocking of our radio signals by Big Ben, we found that the conditions there simply did not permit us to land our gear. The only route available under the permit (which we received only long after our plans were made) was a single one-way trek from the lagoon, or through the violent surf, neither option of which was possible during the expedition. We received numerous very angry emails from DXers who somehow had gotten the idea that a Spit Bay operation would make it easy for them to work VKØEK. Some DXers actually delayed working us until the expected Spit Bay operation would happen, and they were upset when it didn't. To be fair to them, we had widely publicized the potential for the Spit Bay operation, so we didn't blame them for being surprised and upset. Unfortunately, they didn't understand that on an expedition not everything is predictable; it was the restrictions in the permit and the surf conditions, not the expectations of DXers, that determined what the team could do. Ironically, the operation was in fact unnecessary, because analysis of the log showed that the relative number of QSOs with North America West was nominal, thanks in part to long-path.

So back to the field science: Does our field work confirm that Heard Island is changing rapidly, and is it

climate-caused? Yes, on both questions. We documented many features, including glacial slumps that have occurred in the past few years, hundreds of streams pouring out glacial meltwater, the almost total erosion of major breakwaters, the retreat of high mountain glaciers, and the growth of the volcanic vent on the top of the 9000-ft. volcano, that collectively provide a convincing picture of a mountain undergoing major change. The bird and mammal populations resident on the volcano are totally dependent on the structure and processes of the mountain, providing impetus for close monitoring of the populations.

Because subantarctic populations are so highly sensitive to climate, Heard Island can provide a sensitive testing site for models of the effects of climate change, and could provide an early warning of significant changes in the climate. Our philosophy was (and is) that DXpeditions going to very rare and extreme locations such as the Southern Ocean have an opportunity to make a contribution to the general understanding of the Earth, and therefore it is a worthwhile endeavor to include at least some environmental documentation on such DXpeditions. We can, and should, be forward-looking, using DX opportunities to contribute to the worldwide effort to deliver the world to the future as healthy as we inherited it from the past.

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**Scientific collaborators and advisors:** Jodie Fox, Patrick Quilty, and Eric Woehler (University of Tasmania), Mary McGann (U. S. Geological Survey), Grahame Budd (University of Sydney), Erik van Sebille (Imperial College London), Steve Smith (OceanEarth), Callan Bentley (Northern Virginia Community College), and numerous others.

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