

## Only 85% to go!

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We repeatedly hear the old chesnut "We know more about the far-side of the Moon than we do about the seafloor", a reference alluding to the fact that probably only 15% (we will talk about the "probably" shortly) of the seafloor has been mapped at multibeam (let's say 100x100m pixel size) resolution. But should we just keep repeating it? Or should we do something about it? I, together with many other people on the planet, am trying to do something about it. The challenge is huge - as Figure 1 shows, even the surface of the seafloor below 2500m depth is equivalent to twice that of Mars or 6-times that of the Moon. So we need all the help we can get - maybe you can help too?

## Knowing what is already mapped

Surprisingly, even finding out which parts of the seabed have already been mapped is really difficult information to get at. Many countries have a national data centre where bathymetric data from their ships are archived. But in many cases these archives are not, or only poorly, searchable, often because the researchers who led the cruise did not provide much metadata with the multibeam files when they were submitted to the archive. If these files are in proprietary multibeam-hardware formats, then the people running the data archive often have no way of extracting that information from the data sets. The result is masses of data safely stored but essentially inaccessible, like a library full of books with no idea of their titles or authors. Efforts are underway to

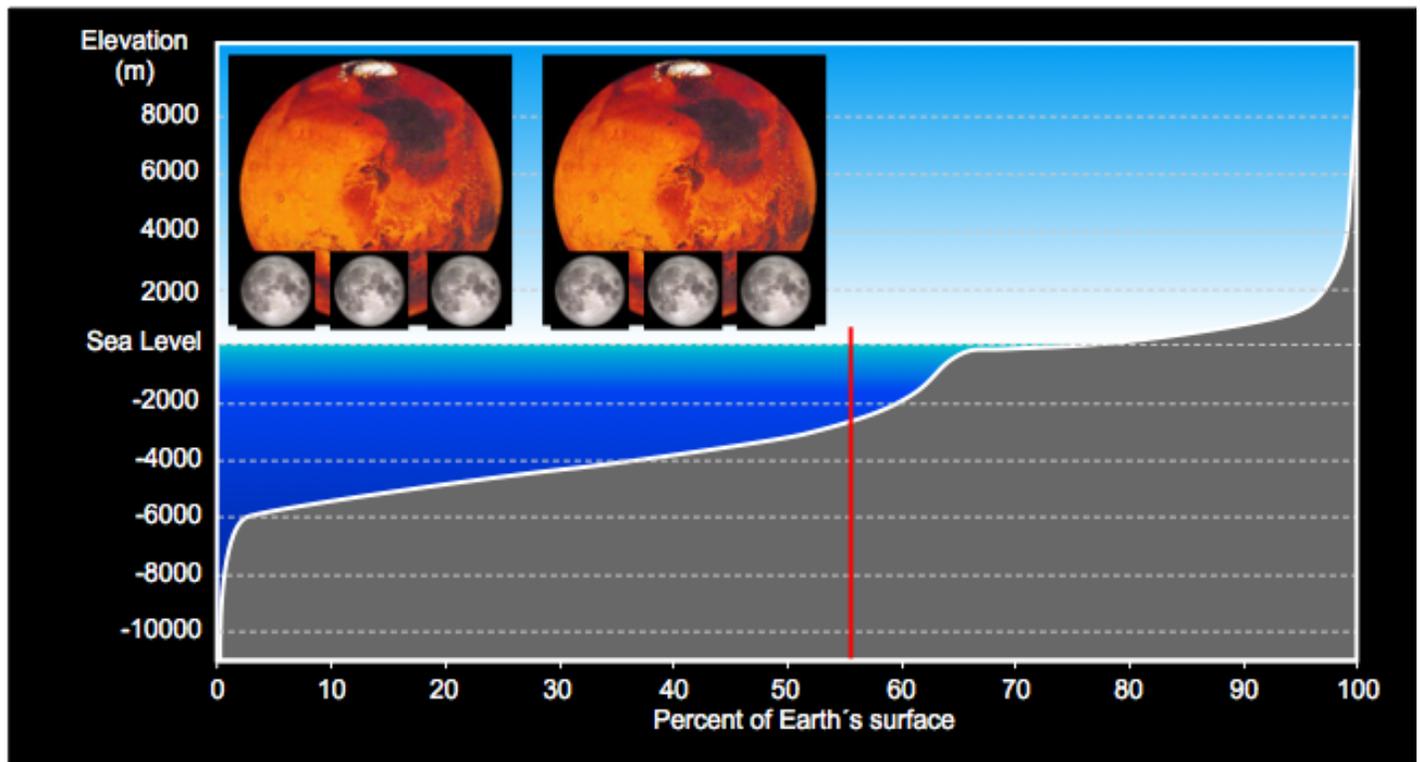


Figure 1: The hypsometric curve of Earth, showing cumulative percentage of the surface versus sea level. Pictures of Mars (© mepag.jpl.nasa.gov) and the Moon (© nasa.gov) are shown at the same area scale to illustrate their surface areas relative to that of Earth - Mars has 28%, the Moon 7% the surface area of Earth.

There are three parts to the problem: (a) knowing what is already mapped; (b) getting the legacy data for those already-mapped areas into the public realm and (c) mapping the rest. So how do we go about it?

try and change this situation, with projects like "AtlantOS" in the EU ([atlantos-h2020.eu](http://atlantos-h2020.eu)) looking to provide maps showing the tracklines of all available data in European repositories. The governments of the EU, US and Canada have also got together with the goal of, among other things, mapping the whole Atlantic (under an agreement known as the "Galway Statement"; see [https://ec.europa.eu/research/iscp/pdf/galway\\_statement\\_atlantic\\_ocean\\_cooperation.pdf](https://ec.europa.eu/research/iscp/pdf/galway_statement_atlantic_ocean_cooperation.pdf)) and are also working on this accessibility issue - their portal showing all

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discoverable data for the North Atlantic is available at [https://maps.ngdc.noaa.gov/viewers/north\\_atlantic/](https://maps.ngdc.noaa.gov/viewers/north_atlantic/).

Many ships also have "logging software" running when at sea which makes the generation of the necessary metadata an automatic process. All of these points mean that, at least for the future, archived bathymetric data should be discoverable.

### ***Making legacy data publicly available***

Where is all the data we, as scientists and cruise leaders, have collected over the years? With any luck it is archived in a public repository (see above). With more luck, it is "discoverable" in that repository. And in the best of all worlds, the data is also freely available and so can be freely accessed by anyone wanting a map of a particular region. Sadly, many datasets are not that lucky. They are sitting on a hard-drive in some scientist's office. Or stored on a DVD, magnetic tape or some other offline medium. To change this situation, only one thing can help - we, the scientists, have to nurture a culture of data sharing, making data which we have already published or are never, honestly, going to work on publicly available. Our model here should, I think, be space science or high-energy physics, for one very simple reason - they make lots of their data available openly almost immediately (NASA alone has over 2 Petabytes (yup, that is 2000 Terabytes) of data online) and receive funding that ocean sciences can only dream of. Coincidence? I do not think so. By taking their data into the public realm, by being open and communicative with their science, they catch the attention of public and politics alike, making financing their science, even though it is much more expensive than ours, so much easier. Finding Higg's boson or producing a map of the seafloor - which is more immediately relevant to life on our planet, would you say? But which cost more to accomplish? Get the picture?!

### ***Mapping the rest***

Mapping the ocean at multibeam resolution at present means a ship has to go there. The international oceanographic community, of which InterRidge is an integral and important part, has access to probably 100 ships with deep-water multibeam mapping capability. Because mid-ocean ridges are often located in international waters, InterRidge scientists often make long transits to get to their working areas and back. And it is these transits which could, potentially, help make inroads into the "missing" 85%. Here again it is up to the scientists (this means you and me!) to make this happen

- during transit to a ridge, turn the multibeam on at the latest when you are in international water (and sooner if you have the required permission from the coastal state - often this is easy to get). If you are going back to somewhere you have been before - offset the transit track by a couple of miles to get a second swath mapped. And collect the acoustic backscatter information too - there is a lot of geological information in that signal to complement the bathymetric data.

### ***The big push***

Getting all available data online and maximizing the transits of research vessels is still not going to map the whole ocean - for that it will need a concerted international effort. The obvious body to do this is GEBCO - who have been compiling and publishing seafloor maps since 1903! This international body, with close ties to the International Hydrographic Organisation and UNESCO, has recently teamed up with the Nippon Foundation with the goal of mapping the whole oceans at 100m resolution by 2030 (see <https://seabed2030.gebco.net>). An ambitious target and one which the partners themselves admit will be hard to reach. But they are serious - the Nippon Foundation is providing US\$ 18.5 mill. over 10 years to coordinate the effort. All of us can help them. I hope the InterRidge community will do its part!

Kiel, 1 November 2017