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Canberra observed

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New sea-floor data released from MH370 search area

Geoscience Australia has released the sea-floor data collected during the second phase of the search for missing Malaysia Airlines flight MH370. See: http://www.ga.gov.au/news-events/news/latest-news/the-data-behind-the-search-for-mh370-phase-two-data-released.

The search for MH370 involved collecting large amounts of data in a remote part of the southern Indian Ocean (see Figure 1). It was conducted in two phases – the first phase was a survey to collect bathymetry data to develop maps of the sea floor topography in the search area. These maps were then used to safely guide the second phase of the search – underwater.

Phase One data were released in July 2017, and Phase Two were released in June 2018.

As we all know the missing aircraft was not located within the 120 000 km^2 underwater search area, and in January 2017 the search was suspended until 'further credible evidence is available that identifies the specific location of the aircraft'.

The Phase Two data were collected using sidescan and multibeam sonar mounted on towed and autonomous underwater vehicles. During the search, points of interest were identified and investigated in more detail (see Figure 2). An underwater vehicle descended to each of these locations, where higher resolution sonar, photographic or video imagery was acquired to identify the features. This imagery revealed geological features

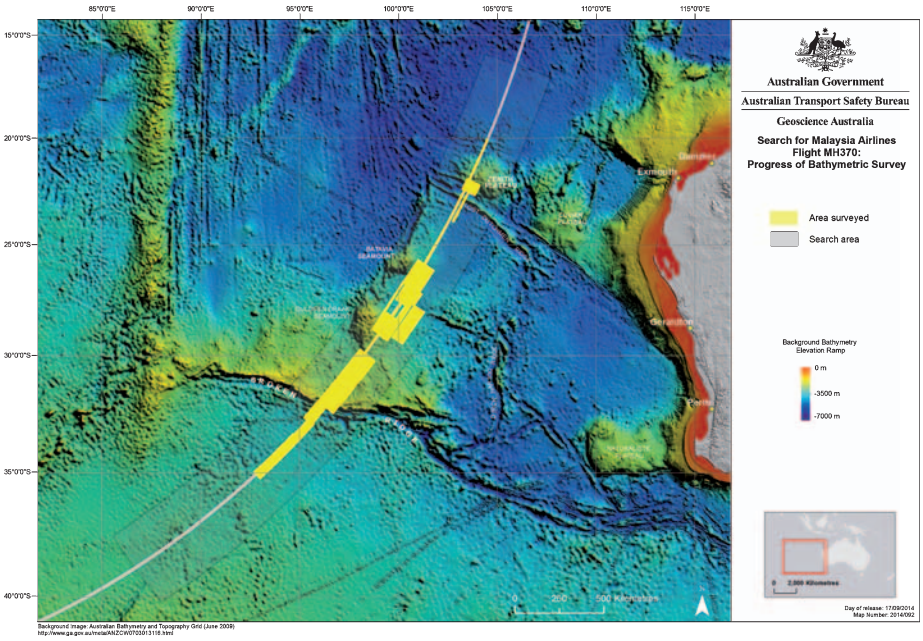

Figure 1. *Search area for MH370 shown in yellow. Source: https://www.atsb.gov.au/mh370-pages/the-search/maps/.*

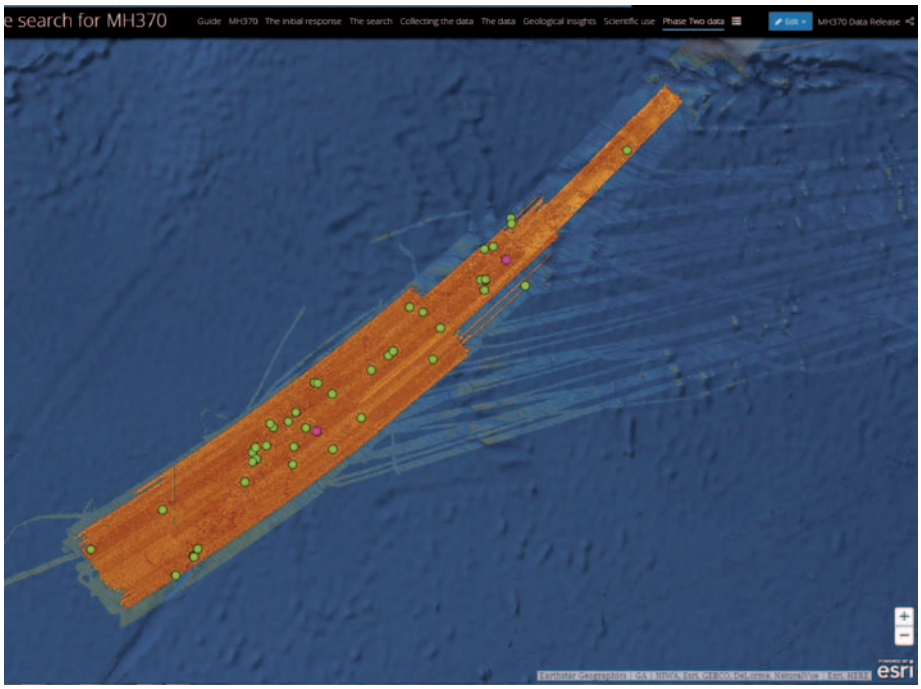

Figure 2. *Sites selected for sidescan and multibeam sonar data in the search for MH370. The green circles were sites of interest but unlikely to be significant in the search. The red circles were on high interest and warranted further investigation. Image provided courtesy of Geoscience Australia, see: https://www.atsb.gov.au/mh370-pages/the-search/maps/.*

of the ocean floor, and a range of items including whale bones and the remains of several ship wrecks.

Although the search for the aircraft was unsuccessful, the Phase One data show the sea floor in never-before-seen detail, revealing ridges 6 km wide and 15 km long that rise 1500 m above the sea floor, and fault valleys 1200 m deep and 5 km wide.

Together, these datasets contribute to a greater understanding of the geology beneath the deep ocean and the complex processes that occurred there. Geoscience

Australia has produced *an interactive story map about the search for MH370, exploring the data that has been collected.*

Figures 3 and 4 show the before and after images for the sea floor and more detail obtained over the Diamantina fracture zone.

The following URL makes compelling viewing: https://geoscience-au.maps.arcgis.com/apps/Cascade/index.html?appid=038a72439bfa4d28b3dde81cc6ff3214.

It is possible to watch the whole story of the search for MH370 evolve, starting with flight paths of the aircraft and finishing with shipwrecks on the floor of the Indian Ocean – and you can appreciate the difficulty of finding the missing aircraft in such a vast rugged terrain.

Geoscience Australia has done a wonderful job in carrying out this work and in making the data sets available.

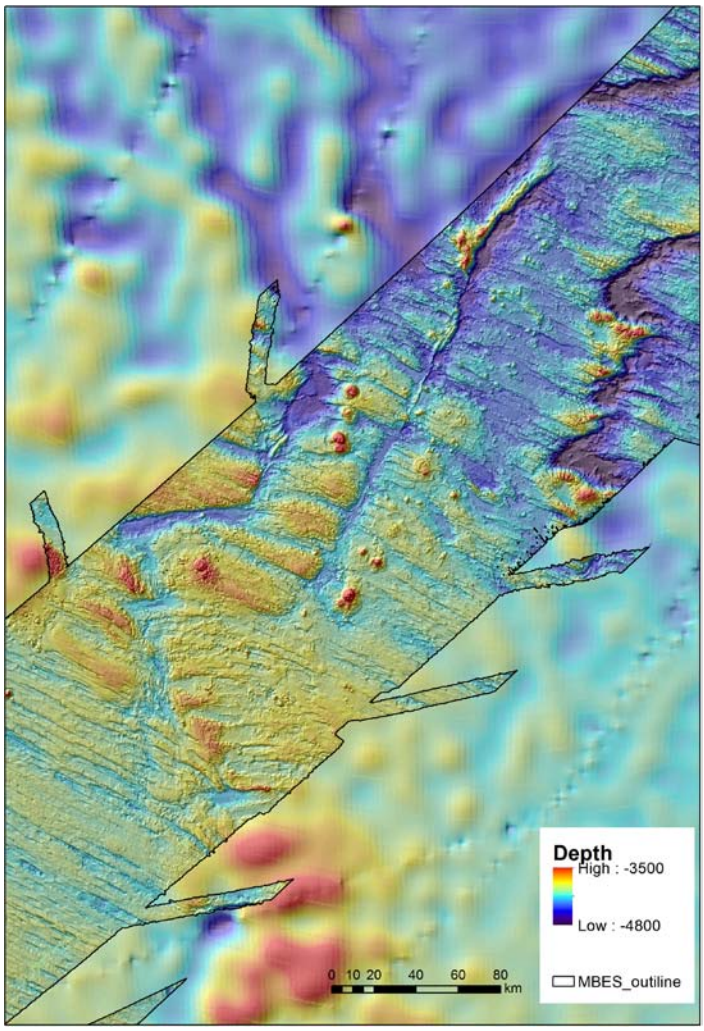

Figure 3. *Before and after MH370 data. The image shows the difference between the Phase One data and the data that existed before the search for MH370. The Phase One bathymetric data is seen through the middle of the image, compared to the satellite-derived data that was available before the search. Image provided courtesy of Geoscience Australia.*

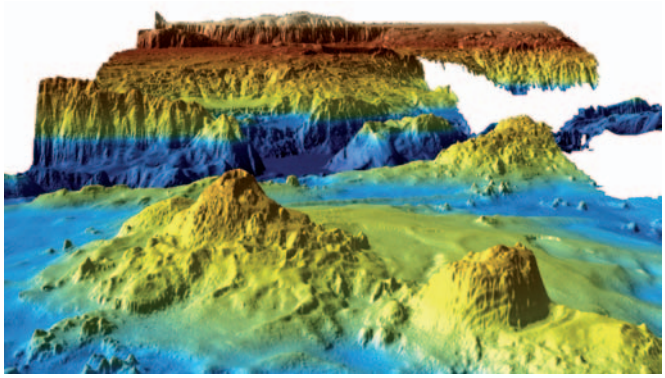

Figure 4. *Diamantina Fracture Zone: A 3D image of the bathymetry looking northeast into the Diamantina Escarpment. Image provided courtesy of Geoscience Australia.*

A national disgrace: the decline continues in government investment in R&D

According to a report released on 6 July 2018 by the Australian Bureau of Statistics, the government investment in R&D decreased by 2% between 2014–15 and 2016–17 (http://www.abs.gov.au/ausstats/abs@.nsf/mf/8109.0). The ABS, unlike similar agencies in other OECD countries, only analyses these parameters every two years. Presumably because of resource constraints.

During the 2016–17 financial year, expenditure on R&D by Australian government organisations was $3279 million. Commonwealth government organisations contributed $2139 million (65%), and state and territory government organisations $1140 million (35%). Figure 1 shows the breakdown of these numbers for the period 1992–2017.

The most disturbing aspect of these numbers is the steep decline in investment, as a proportion of Gross Domestic Product (GDP), during the last four years; from 0.24% in 2012–13 to 0.19% in 2016–17. As you can see, this parameter peaked in 2008–09 and has declined ever since. A very unfortunate trend, to say the least. Some commentators hoped that with Malcolm Turnbull replacing Tony Abbott in September 2015 the trend would be reversed, but this has not happened.

As the then OECD Secretary-General Angel Gurría said in 2016, when he launched the OECD's 2015, Science, Technology and Industry Scoreboard in Korea:

'Public funding has underpinned many of the technologies driving growth today, from the digital economy to genomics. We must continue to lay the technological foundations for new inventions and solutions to global challenges like climate change and ageing and must not let investment in long-term research wane'. (http://www.oecd.org/newsroom/governments-must-step-up-rd-in-frontier-technology.htm).

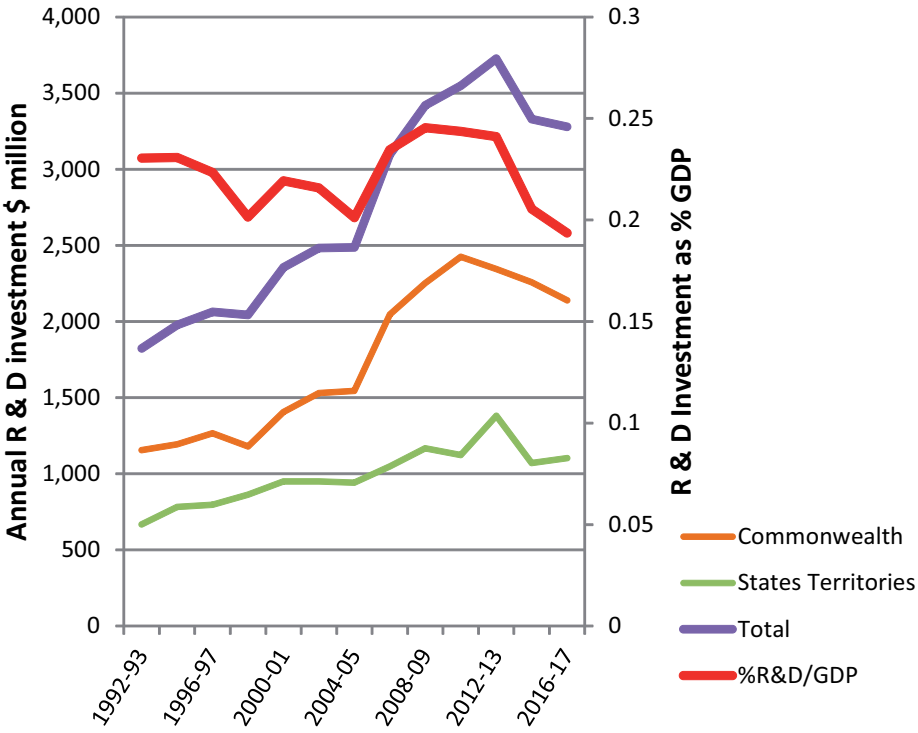

Figure 1. *Government investment in R & D from 1992–2017. The red curve shows the investment as a percentage of GDP. Notice that this peaked in 2008–09 and has declined ever since. Source: http://www.abs.gov.au/ausstats/abs@.nsf/mf/8109.0.*

This statement is still true today. And while we need a strong business R&D effort for the shorter-term challenges, we need governments to fund the longer term basic research and maintain the national data bases. That is why agencies such as the Australian Bureau of Statistics, Geoscience Australia, CSIRO and the Bureau of Meteorology should have their funding allocation coupled to GDP and not be part of the death-by-a-thousand-cuts inflicted annually to all government departments and agencies.

We do not want to be left behind as a nation of baristas, cooks and house-maids relying on tourists visiting the largest island resort on the planet or, as a nation of quarry-operators exporting the most basic of raw materials to the rest of the world.

Hot off the press: A paper by Graham Heinson, Yohannes Didana, Paul Soefy, Stephan Thiel and Tom Wise has just been published in *Nature's* Scientific Reports. The paper is called 'The crustal geophysical signature of a world-class magmatic mineral system' and reports on the use of magnetotellurics to image the fluid delivery pathways of the Olympic Dam mineral system. This work was proudly supported by the ASEG Research Foundation. Take a look for yourself, https://www.nature.com/articles/s41598-018-29016-2.pdf.