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Antarctic Research: Significance to the Global Community

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Antarctica fascinates us. For most people, it is remote, somehow intangible, a subject of fascination or awe on the television or web, but that they will never have the chance or perhaps even want to experience in real life. It is a part of the Earth that is different to any other, and one that apparently provides the utmost contrast to the biological riches of the tropics. A continent of ice, yet with towering and still largely unexplored mountain ranges. The world's coldest, highest, windiest and driest continent and yet, with the Southern Ocean, one that supports spectacular and charismatic wildlife.

Humans first set foot on Antarctica in the last two centuries, and it remains the only continent with no native or truly resident human population. It is also the last continent not to have its ecosystems and environment fundamentally changed by the major human impacts that are all too familiar elsewhere – pollution, over-exploitation, land use change – and where we have perhaps our last chance to demonstrate the ability to manage rationally and not destroy the environment around us. It is a continent that we can increasingly easily visit, but where 'nature' remains in control. Around a century after the well-known expeditions of the 'heroic era', those of us with the privilege of spending time there can still only marvel at and be humbled by the exploits of the original explorers such as Amundsen, Scott, Shackleton, Mawson, Shirase, Charcot, Durmont d'Urville and their teams. Even with all of today's technology, the wildest and most extreme of weather will thwart our ability to move and challenge our survival skills. If Shackleton's classic advertisement of 'Men wanted for dangerous journey .... no guarantee of return' were to be repeated today, the challenge of finding suitable personnel to create the expedition team now would be even greater than it was in the early 1900s!

A vast continent roughly twice the size of Australia, Antarctica is covered except for a tiny proportion of its area, in a blanket of ice on average three to four kilometres deep. If all that ice were to melt, the global sea level would rise by around 65 metres. That is not actually going to happen, even with all the valid current concerns over drastic and undoubted anthropogenic impacts on our environment and atmosphere. But parts of Antarctica are certainly melting, and making a significant contribution to the global sea level rise that is already occurring, and predicted to amount to a metre or more increase in the next century.[1,2] There is increasing attention to the possibility of real collapse of parts of the West Antarctic Ice Sheet on a timescale of centuries, an event that, should it happen, would lead to release of ice equating to up to 7 metres of sea level rise.

Such observations make what should be an unquestionable point: despite its remoteness and apparent 'difference' to those parts of the world we live in as a human population and are familiar with, Antarctica is actually central to the way our planet or 'Earth System' functions. Cold water entering the ocean from its margins drives the circulation of currents across all the oceans, while the atmosphere above the continent is similarly fundamental to and inter-connected with global atmospheric circulation, with all that implies for climate and weather. It should then be self evident that any changes in the way that Antarctica's influence is expressed should be fundamentally important for us to understand, and of the gravest concern.

Antarctica is exceptional amongst the world's continents in many ways, some of those far removed from its obvious environmental extremes and exceptional biology. For a start, it is not made up of parts of 'sovereign states', rather being governed by an international treaty– the Antarctic Treaty - which over time has evolved into the 'Antarctic Treaty System' (ATS). The ATS came into force in 1961 and even then was a rare example of global cooperation and expression of common interest even at the height of the Cold War. In essence, the Treaty set aside Antarctica as a 'continent for peace and science'. It placed the existing territorial claims into abeyance as long as the Treaty itself continues to exist, banned military and nuclear activities, and economic exploitation of the continent. From its original 12 signatory nations, which included those with territorial claims on the continent as well as

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the then superpowers of the USA and USSR, the ATS has now expanded to include 50 signatory nations, with the most recent to join being Malaysia a couple of years ago. These comprise 28 'Consultative Parties', which take part in decision making in the annual Antarctic Treaty Consultative Meeting, and 22 'non-Consultative Parties' – the difference between the two being that the former have demonstrated a substantial presence and programme of research in Antarctica, which is the condition that must be fulfilled to achieve Consultative status. The ATS is a 'consensus governance system', meaning that all Consultative Parties must agree on any proposal to be adopted within the ATS.

So much for history and background, but why is all of this relevant to the nations and scientists of today, and perhaps particularly those of a country like Malaysia, which has only recently joined the group of nations with credible polar research programmes, and whose population and economy appears to sit firmly in the tropics, at the other end of the environmental gradients of the planet from Antarctica?

For the last 50 or so years, since the creation of the ATS, Antarctica has truly been a continent for science, providing a vast natural laboratory for research across many disciplines, including glaciology, geology, climate, oceanography, atmospheric physics, marine and terrestrial biology, adaptation, and many others. In some of these, as described above, it has become clear that Antarctica is itself fundamental to global processes, hence it is perhaps THE central place to study them. In others, such as physiology and adaptation, researchers take advantage of the insights to be gained in studying biological systems that function at the extremes of some of the environmental gradients that exist on the planet.[3,4] Taking a perhaps, more philosophical view of research, Antarctica has been a centre of 'pure' or 'blue sky' research and scientific questioning. Such an approach is today under increasing pressure or threat, as implicit or explicit pressures from governments and funding agencies to gain short-term applied benefits and profits increase. Antarctica is certainly not immune to such pressures, with the widely used but poorly defined term of 'bioprospecting' being encountered increasingly widely either as the core or an add-on to many biological – particularly microbiological – research proposals. Clearly, such research is a necessary part of national and international scientific portfolios, although not of itself likely to be either 'world leading' or to generate fundamental advances in scientific knowledge.

What is clear is that Antarctic science can no longer be argued to be the preserve of a privileged few. Science is increasingly international in its participation and reach. Research in many areas of science requires access to assets, technologies and geographic ranges that are beyond the logistic or personnel capacities of any one nation, and this is particularly true of Antarctic research. With this in mind, only 6 months ago the Scientific Committee on Antarctic Research (SCAR, www.scar.org; an independent committee of the International Council for Science, ICSU) drew together experts from across the Antarctic science community and its component nations for the 'First SCAR Antarctic and Southern Ocean Horizon Scan'.[5,6] This set out to identify what the global scientific community considers to be the most important and pressing scientific challenges and questions that must be addressed based on research in this region on a timescale of the next two decades. With much intensive discussion, the Scan participants boiled down the initial approaching 1,000 questions to a final set of 80, grouped into sections of 'Antarctic atmosphere and global connections', 'Southern Ocean and sea ice in a warming world', 'Antarctic ice sheet and sea level', 'Dynamic earth – probing beneath Antarctic ice', 'Antarctic life on the precipice', 'Near-Earth space and beyond – eyes on the sky' and 'Human presence in Antarctica'. In detail, the 80 questions firmly place Antarctic science in the mainstream of fundamental and important global research, and highlight the need for 'buy in' from not only the global science community, but also national Antarctic operators and national and international funding agencies. High quality, long-term supported and properly conducted collaborative international

research in Antarctica and the Southern Ocean is truly central to our efforts to understand the Earth System, and particularly so in an era of unprecedented and rapid global and anthropogenic change. Few things could be of more significance to the global community – academics, civil society or governments!

Key words : Antarctica, global linkage, environmental change, SCAR, Horizon Scan

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