Garnaut Review Secretariat,
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I, Peter Loveday, AM, PhD, and retired Director of the ANU's North Australia Research Unit in Darwin, hereby put a submission concerning climate change to the Review.

In summary, global warming – and cooling – is geologically inevitable. It is **not**, however, inevitable that warming should be made worse by the uncontrolled use of fossil fuels. Indeed, it could be said that the use of fossil fuels should be restricted, not only to reduce the amount of carbon dioxide and methane emitted into the atmosphere now, but also to conserve fossil fuel sources for use in a future period of cooling to supplement energy generated from wind, solar power and geothermal sources.

My submission is stimulated by the item in *Sydney Morning Herald* of 26.1.08 reporting the `sceptical' views of the Lavoisier Group headed by ex-Senator Peter Walsh.

According to the report in *SMH,* Walsh pointed out in his submission to the review that the cultivation of grapes in northern England and of cereals in Greenland some 1-2000 years ago is proof that `those warmer periods cannot reasonably be attributed to anthropogenic greenhouse gases' and he goes on to suggest that a `cooling period will set in within the next decade or so'. I do not believe that Walsh seriously thinks responsible scientists have actually said or implied that all warming arises from human activity. I also think it is extravagant of him to talk of a cooling period beginning in a decade or so. This is not a prediction, but a hope for which no evidence is offered.

Walsh is quite unconvincing. Reference to Greenland and northern England does not prove anything about global climate change. It proves only that there have been and may again be **`local'** variations of climate from local planetary factors, such as a warmer Gulf Stream, the variations of which have already been established. The effect of changing southern hemisphere ocean currents on the Australian climate – another `local', not global, climate - is well known.

Major **global** changes in climate, both warming and cooling, have occurred for millions of years and will go on occurring as a result of variations in the earth's exposure to the sun. Doug Macdougall, *Frozen Earth, the Once and Future Story of Ice Ages,* University of California Press, 2006, brings together evidence from numerous scientific studies. Briefly, at p139, he says that climate change over the last 550,000 years based on oxygen isotope analysis of deep sea sediments shows that cold and warm periods alternated at roughly 100,000 year intervals. The 100,000 year intervals reflect changes in the eccentricity of the orbit of the earth; another cycle of about 43,000 years is close to the timescale of changes in the tilt of the axis of the earth's rotation and a third cycle of about 20,000 years corresponds well with the wobble of the axis of rotation.

In figure 24, p205, he shows how the climate has fluctuated between warm and cold over the period 50,000 to 20,000 BP from an ice core in Central Greenland with another figure, 23, at p200, which shows a sudden drop in temperature at 12,800 BP, after which it stayed low for 1200 years and then rose suddenly by 8 degrees C. Equivalent measures from ice are not available for Australia, but sea level changes are one firm indicator of temperature change and they show that equivalent changes were occurring here at about the same time. The data for the period from 140,000 BP down to the present in Australia are summarised in Josephine Flood, *Archaeology of the Dreamtime, The story of prehistoric Australia and its people,* JB Publishing 2004.

The data on p29, from a publication she dates at 1994, done by John Chappell of the Research School of Pacific Studies at ANU, are drawn from coral terraces on the Huon Peninsula and from deep sea cores. At 140,000 BP the sea level was about 130m below its present level, at the time of a global glacial maximum. It rose intermittently and to around its present level by about 120,000 BP peaking above present level a little before 120,000 BP. From 120,000 BP the sea level started to fall, with intermittent small rises, until 20,000 BP by which time sea level was about 120m below its present level at approximately the time of another global glacial maximum. The first Aborigines had arrived in about 50,000 BP or a little earlier. After 20,000 BP sea levels rose rapidly with some fluctuations to reach the present level by about 10,000 BP. The colder dry climate of the north of Australia changed in about 10,000 years to something like the present monsoonal regime with consequential changes in available food and in the hunting and gathering strategies of Aborigines. The vast tracts of land known as the Sahul beyond the present northern coastline were submerged beneath what is now the Arafura Sea. The land bridges with Papua New Guinea and with Tasmania were also submerged and something similar happened to land in what is now the Great Australian Bight (Flood p30 for the map, and Cane 2002 and in Anderson et al 2001 for research on the Bight). Even more land may yet be submerged in the present inter-glacial maximum, especially if carbon emissions are not curtailed. The *Sydney Morning Herald* (10.11.2006) reported research from the Centre of Excellence for Coral Reef Studies in Townsville which had dated a coral reef in Foul Bay, WA, to 125,000 years ago. The importance of this is that, because the reef is the most southerly ever found and now above sea level, the sea must have been much warmer and at a higher level than it is now, which the researchers thought could well be a foretaste of present global warming, by whatever causes induced.

From 10,000 BP on, for another 5-6,000 years, the **local** effects continued to be felt as the river systems of north Australia were modified by the new climate regime. The research for this period has been carried out by Chappell and staff of the North Australia Research Unit when I was its Director; see CD Woodroffe, J Chappell, BG Thom and E Wallensky, *Geomorphological Dynamics and Evolution of the Alligator Tidal River and Plains, Northern Territory,* North Australia Research Unit, 1986. They describe the principal local changes in chapter 5. Local lag effects mean that dates of an event are not uniform across the continent and may not be of the same magnitude.

Above all, the account Macdougall gives of the forces on the planet which result in climate variation are of a kind to **never** reach an equilibrium point. In other words, human economic activity must be prepared to grapple with both warming of the planet, perhaps beyond what we already know and are adjusted to, and with cooling.

Indeed, it could be said that the use of fossil fuels should be restricted, not only to reduce the amount of carbon dioxide and methane emitted into the atmosphere now, but also to conserve fossil fuel sources for use in a future period of cooling to supplement energy generated from wind, solar power and geothermal sources. Current non-interventionist economic theories and policies based on them for both short and long terms are not an option, particularly if the interests of the nation states and their rulers are treated as paramount,

Flood provides a comprehensive bibliography, although much of it is not relevant to climate change. Other relevant references may be cited here, namely:
Scott Cane, *Pila Nguru, the Spinifex People* 2002 and The Great Flood in Anderson, A et al, *Histories of Old Ages, Essays in Honour of Rhys Jones*, Pandanus Press, 2001
Mulvaney, J and Kaminga, J: *Prehistory of Australia* 1999
Smith, MA, M Spriggs, B Frankhauser, *Sahul in Review*, ANU 1993

Signed: Peter Loveday, Glebe, NSW
28 January 2008.