33. CLIMATE (OCEANS) AND THE CONSTITUTION #6

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July 26, 2010

For Immediate Release (See Related Releases Nos. **10**, **29**, **30**, **31** & **32** of February 22, July 2, 14, 19, and 23, 2010)

Former Senator Schmitt Summarizes Dominating Role of Oceans in Climate Change

The scientific rationale behind the Environmental Protection Agency's proposed massive intrusion into American life in the name of fighting climate change has no supporting scientific or constitutional justification. This hard left excursion into socialism, fully supported by the Democrat Congressional Leadership, some States, and the President, has no basis in observational science as has been discussed previously relative to climate history, temperature, and carbon dioxide.

The oceans of the Earth play the dominant role in the perpetuation and mediation of naturally induced change of global climate **[1]**. Density variations linking the Northern and Southern Hemisphere portions of the Pacific and Atlantic Oceans through the Southern Ocean drive the primary circulation system that controls hemispheric and global climate. Differences in temperature and salt concentration produce these density variations that circulate heat around the planet. For the last several years in this circulating environment, the sea surface temperature of the oceans appears to be leveling off or decreasing **[2]** with no net heat increase for the last 58 years **[3]** and particularly since 2003 **[4]** and possibly since 1990 **[5]**. The long-term climatic implications of this recent broad scale ocean cooling are not known.

Density increase due to evaporation in the North Atlantic normally creates a salt-rich, cold, deepwater current that generally flows south to join the Antarctic Circumpolar Current. Upwelling from that Circumpolar Current brings nutrient and carbon dioxide-rich deep seawater into the upper Southern Ocean. This Southern Ocean water then moves north into the Pacific toward the equator where it joins a warm water current flowing from the North Pacific, through the tropics and the Indian Ocean, and then northward through the Atlantic to become the Gulf Stream. The Gulf Stream flows into the North Atlantic where, as part of a continuous process, wind-driven evaporation increases salt concentration and density and feeds the deepwater flow back to the south. Natural interference in the normal functioning of the ocean conveyor can occur. At times during the Last Glacial Maximum between 23,000 and 19,000 years ago, strong evidence exists that current flow in the Atlantic changed, bringing old, deep water from the Southern Ocean, northward **[6]**, rather than from the Indian Ocean as is the pattern today. Also, melting of Northern Hemisphere ice sheets, accumulation of melt-water behind ice dams, and abrupt fresh water inputs into the North Atlantic cause major disruptions in global ocean circulation [7]. For example, as the North Atlantic cooled 18,000 to 15,000 years ago due to meltwater infusion, extreme, long-term drought prevailed in the monsoon regions of Africa and Asia [8].

The oceans both moderate and intensify weather and decadal climate trends due to their great capacity to store solar heat as well as their global current structure, slow mixing, salinity variations, wind interactions, and oscillatory changes in heat distribution over large volumes [9]. The Northern Pacific Decadal Oscillation (PDO) [10], the El Nino-La Nina Southern Pacific Oscillation (ENSO) [11], the long period “anchovy-sardine” Southern Pacific Oscillation [12], the Gulf Stream Northern Atlantic Oscillation (NAO) [13], the Indonesian Through-Flow (ITF) [14], the Agulhas Current [15], and other related ocean currents and cycles have demonstrably large, decadal scale effects on regional as well as global climate [16].

Possibly the greatest oceanic influence on global climate results from the full hemispheric reach and scale of the Southern Ocean’s Circumpolar Current as it circulates around Antarctica and between the continents of the Southern Hemisphere [17]. In particular, the northward migration of the cold to warm water front off South Africa during ice ages may restrict warm, salty water of the western Indian Ocean’s Agulhas Current from entering the South Atlantic and eventually amplify ice age cooling in North America and Europe [18].

In several major portions of the global ocean heat conveyor, natural variations in heating, evaporation, freshwater input [19], atmospheric convection, surface winds, and cloud cover can influence the position and strengths of related local ocean currents near the continents. This variation in current positioning, therefore, modifies carbon dioxide uptake and release, storm patterns [20], tropical cyclone frequency [21], phytoplankton abundance [22], drought conditions, and sea level rise that drive the reality of, as well as our perceptions of climate change.

For example, since about 7000 years ago, sea level rise has averaged about eight inches (20cm) per century for a total of about 55 feet (16m) [23]. This same approximate rate appears to have held from 1842 to the mid-1980s [24]. The trend in sea level rise between the early 1900s and 1940 showed no observable acceleration attributable to increasing atmospheric carbon dioxide [25]. Satellite data show an apparent 50% increase of this rate after 1992, but this presumably will slow again soon due to the effects of the current period of global cooling. If the post-Ice Age slow rate of long-term global warming (about 0.5°C per 100 years) should continue for 100 years, the total sea level rise attributable to worldwide glacier melting and ocean thermal expansion would be no more than about four inches (10 cm) [26].

Greenland’s ice sheet also plays a cyclic role in sea level changes. In the 1950s, Greenland’s glaciers retreated significantly only to advance again between 1970 and 1995 [27], a pattern of retreat and then advance repeated again between 1995 and 2006 [28]. Predicting future sea level rise from short-term observation of Greenland’s glaciers would seem to have little validity, particularly as there appears to be a half a decade lag in observable melting and ice accretion responses relative to global temperature variations [29]. The same conclusion now can be made relative to Himalayan glaciers [30].

There also seems to be little danger of a catastrophic melting of the East Antarctic Ice Sheet that would cause a major rise in sea level [31]. Great uncertainty also exists relative to the natural dynamics and history of the West Antarctic Ice Sheet with Ross Sea sedimentary cores suggesting that major cycles of ice cover changes have occurred over the last five million years [32]. Overall, short-term sea level changes relate more to local geological dynamics in underlying Earth's crust than to glacial variations [33].

Compilations of temperature changes in the oceans and seas, as preserved by oxygen isotope variations in shells from cores of bottom sediments, provide a record of natural oceanic reactions to cycles of major climate change back for 1.8 million years [34]. For example, geological analysis of sea level changes over the last 500,000 years show a remarkable correlation with major natural climate change [35]. These data further indicate that the Earth probably is approaching the peak of the warming portion of a normal climate cycle that began with the end of the last Ice Age, about 11,500 years ago [36].

The oceans play the major role in removing carbon from the atmosphere; however, the total carbon in the oceans and its distribution remains poorly understood [37]. Seawater calcium and various inorganic and organic processes in the oceans fix carbon from dissolved carbon dioxide as calcium carbonate [38], parts of planktonic and benthic organisms, and inedible forms of suspended carbon [39]. In so doing, these processes constitute major factors in global cycles of atmospheric carbon dioxide concentration. Calcium availability in the oceans, in turn, relates to major geological dynamics, including mountain building, volcanism, river flows, and the growth, alteration, and destruction of crustal plates beneath the oceans.

Over the last 28 million years, marked variations in the ratios of precipitated calcium isotopes from seawater, particularly beginning about 13 million years ago, indicate major changes in sources of calcium rather than major variations in the quantity of atmospheric carbon dioxide [40]. This change in seawater calcium isotopic makeup may relate to events that included the partial deglaciation of Antarctica [41]. As most plant activity requires carbon dioxide, low atmospheric carbon dioxide values would reduce the rate of biologically assisted rock weathering. A limit on such weathering may buffer minimum atmospheric carbon dioxide to between 150 and 250ppm by limiting levels of seawater calcium [42].

Significant introductions of calcium into the oceans from any source would be expected to result in a drawdown of atmospheric carbon dioxide to maintain chemical balances in local as well as global seawater. Ultimately, the history of seawater calcium concentrations may explain many of the long-term variations in carbon dioxide levels shown in various studies; however, correlations between calcium dynamics and carbon dioxide levels are not at sufficient geological resolution to make firm, dated correlations. Similarly, anomalous introductions of carbon dioxide, particularly those caused by major volcanic events, can disrupt normal ocean processes involving calcium. This appears to have happened, for example, about 200 million years ago [43] and 120 million years ago [44]. Such events remain unpredictable and rare and, other than in two or three extreme long past examples, do not simulate the adaptive responses of the biosphere as do the usual long-term variations in atmospheric carbon dioxide due to natural cycles of warming and cooling.

Very slightly reduced ocean alkalinity (ocean pH is stable at 8-8.2 and may be higher in shallow water [45]) of the local environments of sea dwelling organisms may occur related to the absorption of new emissions of carbon dioxide, natural or otherwise **[46]**. On the other hand, extreme alarmist hand wringing to the contrary **[47]** attempts to make it appear that the oceans are acidic (pH less than 7.0). Loss of ocean carbon dioxide due to naturally rising temperature works to mitigate acidification trends as will organic and inorganic processes that control ocean acidity by broad scale chemical buffering (reactions going forward or back depending on chemical concentrations) **[48]**.

Iron ion and iron complex concentrations in seawater, mediated by oxidation potential (Eh) and hydrogen ion concentration (pH), play an additional role in organic carbon fixation. Relatively simple laboratory experiments suggest that decreases in ocean alkalinity might reduce availability of chelated iron in the life cycle of phytoplankton **[49]**. The complexity of this process in nature, however, and the many other variables that potentially would play a role in iron metabolism, indicate a need for a much more comprehensive experimental analysis before conclusions can be drawn.

Additionally, there appears to be a relationship between sea surface temperature and phytoplankton biomass in the oceans as intuitively might be expected. Phytoplankton are estimated to constitute approximately half of the Earth's total biomass. Increasing sea surface temperature over the past 110 years post-Little Ice Age warming, however, appears to be correlated globally with declining biomass **[50]**; although individual ocean areas show significant variability. Over about 2000 years, foraminifera biomass in the far North Atlantic seems to correlate inversely with water temperature until, strangely, about 1900, the end of the Little Ice Age cold period **[51]**. At that point, warming temperature correlates with increasing biomass of foraminifera. It is clear that more extensive integration of historic, modern, and satellite observations, as well as data on predator abundances, biomass preservation in sediment cores, and ice cover effects over time will be required to understand these relationships. It may be, for example, that declining fish populations have resulted foraminifera biomass increase over the last 100 years.

Exactly what may happen in specific ecosystems remains uncertain relative to small increases or decreases in the alkalinity of ocean habitats or the change in the quantities and ratios of dissolved oxygen, carbon dioxide, nitrate, phosphate, and silica **[52]**. Coral reefs, phytoplankton, and other ocean organisms, for example, have been very adaptable over geologic time and extensive research strongly suggests that they adapt well, on a global scale, to long-term climatic changes and small associated chemical changes in the oceans **[53]**. So far, research indicates that some organisms benefit and some do not **[54]**, as might be expected. Indeed, this interplay between losses and gains has occurred many times in the geologic past as nature has continuously adjusted to climatic changes much greater than the slow natural warming over the last 350 years. The Earth's vast layers of carbonate rocks derived from carbon fixing organisms, including ancient, now dead coral reefs, as well as deeply submerged coral reefs on existing sea mounts **[55]**, show that the production and evolution of such organisms remains a continuous, if possibly, locally or regionally punctuated process.

In the face of the overwhelming dominance of the oceans on climate variability, it would appear foolish in the extreme to give up liberties and incomes to politicians in Washington and at the United Nations in the name of "doing something" about slow climate change.

The President, regulators, and Congress have chosen to try to push Americans along an extraordinarily dangerous path. That path includes unconstitutional usurpation of the rights of the people and the reserved powers of the States as well as economic stagnation. Current and future Congresses absolutely must get this right!

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