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TITLE: Gas Hydrates: the Gent debates. Outlook on research horizons and strategies

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ABSTRACT:

In 1811 Sir Humphry Davy, who gained fame for both his research on the methane-laden atmospheres in British coal mines and his synthesis of various new elements and compounds, witnessed the first chlorine hydrate crystallizing. At that time he probably did not imagine that 185 years later methane hydrates would fuel heated debates under the gothic vaults of a former Dominican monastery in Gent. Natural gas hydrates have come a long way. From a mere chemical curiosity they proved, as early as the mid-1930s, to be a nuisance for the natural gas industry. Its impact increased in the 1970s, with even the largest pipelines from offshore or arctic fields or the wells from high-pressure underground storage facilities becoming clogged by hydrate plugs. As todays hydrocarbon industry makes a strategic move towards the continental slope, oceanic gas hydrates are increasingly recognized as a major potential hazard for the stability of offshore structures in various deep-water hydrocarbon provinces. Beyond these direct interferences with man's industrial ventures, gas hydrates are gradually moving onto the foreground of global climate debates. If present estimates of methane hydrate volumes stored in the oceanic margin sediments are substantiated, natural gas hydrates represent, under the present climatic and oceanographic conditions, by far the largest mass of organic carbon stored in a potentially dynamic reservoir of the globe's carbon cycle. Their stability is controlled to a large extent by the temperature regime of the oceans and by pressure conditions on the seabed, both of which are directly linked to sea-level changes. This vast quantity of 'frozen' greenhouse gas may have played a significant role in the global symphony of ice ages and the dramatic climatic shifts which characterize the Late Cenozoic world. And it may still play a role today, perhaps hardly noticed against the background of the present world's CO2-driven climate machine. But we cannot exclude the possibility that any major modification of the ocean's dynamic thermal structure in a warming world might unleash vast amounts of methane from its seabed reservoir. Such a release would potentially contribute to the already anticipated evolution of the Earth's atmosphere, with methane at sometime in the foreseeable future replacing carbon dioxide in its prime role as a global warming agent. Is such a scenario possible, even plausible? Can we quantify it and introduce it into our models? Does it imply a fundamental change in our modelling approaches, and should the now familiar coupled ocean-atmosphere models give way to coupled seabed-ocean-atmosphere models? Can the estimates of the scale of the hydrate reservoir be substantiated by any ground-truthing? How can the mechanisms of mass and energy transfer between the seabed, ocean and atmosphere, linked to hydrate

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