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Refractory deep-ocean dissolved organic matter: Enigmas and inconsistencies about its formation and transformation?

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Deep-ocean dissolved organic matter (DOM) is generally considered recalcitrant to prokaryotic utilization corresponding to the average radiocarbon age of DOM of 4000-6000 yrs. There is evidence that the bulk of this refractory deep water DOM originates from prokaryotic processing of organic matter. The rates of formation of recalcitrant DOM are largely enigmatic as are the mechanisms making deep-water DOM potentially available again for prokaryotic utilization. There is evidence, however, that some members of the deep-water prokaryotic community are capable to utilize recalcitrant DOM. Measuring simultaneously oxygen utilization and biomass production of deep water prokaryotes result in rather low growth efficiencies of > 2% corresponding to the refractory nature of the deep-water DOM pool. However, measured respiration rates in incubation experiments are at least one order of magnitude higher than direct water column measurements of apparent oxygen utilization and the derived oxygen utilization rates. Decompression of prokaryotes, required to perform these metabolic rate measurements, might induce some stress-response in prokaryotes, however, these high respiration rates measured in the incubations can only me maintained if deep-water DOM is accessible for prokaryotic utilization. In this presentation the formation pathways of refractory DOM in the deep sea will be critically reviewed as well as evidence for prokaryotic utilization of deep sea DOM.