CO2-fixation by Type X methanotrophs

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Methanotrophs (methane-oxidizing bacteria), as well as thiotrophs (sulfur-oxidizing & CO2-fixing bacteria), are important primary producers and symbionts for the deep-sea chemosynthesis-dependent animals such as vestimentiferan and pogonophoran tubeworms. Vestimentiferans host mostly thiotrophs, while pogonophorans harbor thiotrophs and/or methanotrophs. The apparent double symbiosis of pogonophorans may be explained by the involvement of Type X methanotrophs capable of both methane-oxidation and CO2-fixation. We have detected the symbiotic bacteria that bear the genes encoding Type X methanotrophic 16S rRNA, methane mono-oxygenase (CH4-oxidizing enzyme) and RuBisCO (CO2-fixing enzyme). The Type X species should be advantageous in carbon assimilation, because 1) part of CH4 is assimilated as biomass and 2) the rest is oxidized to CO2 and assimilated by RuBisCO. Net release of CO2 via CH4-oxidation should be thus minimized. The apparent double metabolism strategy exhibited by Type X methanotrophs is discussed in terms of ecology and economics relevant to CO2 dynamics.