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Novel *Chloroflexi* genomes from the Challenger Deep reveal metabolic strategies for the adaptation to deep-sea habitats

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Microbial metabolisms in the deep ocean are controlled by the generally depleted but periodically fluctuating supply of organic matter (OM). Currently, little is known about genomic basis and metabolic potentials of dominant deep-sea microorganisms to cope with the varied OM inputs, especially for those living in the hadal trenches. In this study, we provide an extensive examination of metabolisms of hadal sedimentary *Chloroflexi*, a phylum dominant in the hadal trenches and the global deep ocean. Sixty-two metagenome-assembled-genomes (MAGs) were reconstructed from 9 metagenomic datasets from sediments of the Challenger Deep, the Mariana Trench. These MAGs represent 6 novel species, 4 novel genera, 1 novel family and 1 novel order within the classes *Anaerolinea* and *Dehalococcoidia*. Fragment recruitment showed that these MAGs are the major members of microorganisms in the hadal trench sediments, and are also globally distributed in deep-sea waters and surface sediments. Transcriptomic analysis further suggested high *in-situ* activities of the MAGs. The recovered hadal *Chloroflexi* mainly have an organo-heterotrophic lifestyle, with the potential to degrade a wide range of organic carbon, sulfur and halogenated compounds. Remarkably, our results reveal for the first time that hadal *Chloroflexi* harbored pathways for complete degradation of polyaromatic hydrocarbons (PAH, e.g. fluorene), polychlorobiphenyl (PCB, e.g. 4-chlorobiphenyl) and organochlorine compounds (e.g. chloroalkanes, chlorocyclohexane), via hydrolytic and oxidative processes. Moreover, these organisms show the potential to synthesize energy storage compounds such as trehalose, and have regulatory modules to respond to changes in nutrient conditions. These metabolic features are consistent with a “feast and famine” metabolic strategy, which allows *Chloroflexi* bacterium to efficiently consume labile OM and store the energy under rich OM conditions, and to survive under OM limitations by utilizing stored energy and degrading recalcitrant OM. The findings expand the knowledge on metabolic potentials of deep-ocean *Chlorolfexi*, and highlight their significance in deep-sea carbon, sulfur and halogen cycles. The metabolic plasticity likely provides *Chloroflexi* with advantages for the survival under variable OM inputs in the hadal trenches and other deep-sea habitats. This study therefore provides a new perspective on the metabolism and adaptation strategies of *Chloroflexi* in deep-sea environments.