|  |  |  |
| --- | --- | --- |
| **Process** | **Marker enzyme** | **Taxon** |
| Aerobic C fixation | RuBisCO  phosphoribulose kinase | *Viridiplantae*  *Gammaproteobacteria* |
| Respiration | cytochrome C oxidase | *Proteobacteria* |
| Anaerobic C fixation | ATP-citrate lyase  2-oxogluterate:ferredoxin oxidoreductase  fumerate reductase  CO dehydrogenase/acetyl-CoA synthase | *Firmicutes*  *Proteobacteria* |
| Fermentation | L-lactate dehydrogenase  pyruvate:ferredoxin oxidoreductase | *Mollicutes* |
| CO oxidation | carbon-monoxide dehydrogenase | *Alphaproteobacteria* |
| Photoheterotrophy | photosynthetic reaction center  rhodopsin | *Alphaproteobacteria*  *Alphaproteobacteria* |
| N fixation | nitrogenase | *Epsilonproteobacteria* |
| Denitrification | nitric oxide reductase  nitrous oxide reductase | *Gammaproteobacteria* |
| DNRA | nitrite reductase | *Cytophagia* |
| Anammox | hydroxylamine oxidase | *Deltaproteobacteria* |
| N mineralization | glutamate dehydrogenase | *Alphaproteobacteria*  *Gammaproteobacteria* |
| N assimilation | assimilatory nitrate reductase  glutamine synthetase | *Proteobacteria* |
| Dissimilatory sulfate reduction | APS reductase (*apr*AB)  sulfite reductase (*dsr*AB) | *Deltaproteobacteria* |
| Sulfur oxidation | sulfite oxidase (*sox*B) | *Alphaproteobacteria* |
| S assimilation | adenyl sulfate kinase  sulfate adenylyltransferase | *Gammaproteobacteria* |
| S mineralization | cysteine dioxygenase  3-mercaptopyruvate sulfurtransferase | *Proteobacteria* |
| DMS oxidation | DMS monooxygenase |  |
| DMSO reduction | anaerobic dimethyl sulfoxide reductase |  |
| DMSP cleavage | DMSP lyase (*ddd*D, *ddd*L, *ddd*P) |  |

Table 2. Marker genes involved in carbon, nitrogen and sulfur cycling detected in Organic Lake metagenomes and frequently associated taxonomic groups. See Figure S6 for frequencies of all taxonomic groups.