Carbon cycle:

|  |  |  |
| --- | --- | --- |
|  | ME | TB |
| Allocthonous (aromatics, cellulose) | Planctomyces, Verrucomicrobia, Tenericutes, Bacteroidetes, Cyanobacteria, Burkholderiales | Verrucomicrobia, Bacteroidetes, Gallionella, Solirubrobacterales, Geobacteracaeae, Burkholderiales, Actinobacteria |
| Autocthonous (algal sugars: rhamnose, fucose, arabinose, xylose, mannose, galactose, glucose) | Nearly everything | Nearly everything |
| Autocthonous (one carbon compounds) | Methylococcales, Methylophilacaea, Planctomyces, Rhodocyclaceae | Methylococcales, Methylophilaceae, Burkholderiales, Rhizobiales, Nitrosomonadaceae, Geobacteraceae, Solibrubrobacterales |
| Autocthonous (chitin, chitobiose, NAG) | Planctomyces, Verrucomicrobia, Cyanobacteria, Bacteroidetes, Actinobacteria | Verrucomicrobia, Holophagales, Bacteroidetes, Ignavibacteria, Helicobacterales |
| Primary Producers | Cyanobacteria, Rhodocylclaceae, Burkholderiales | Actinobacteria, Chlorobiaceae, Helicobacteraceae, Comamonadaceae, Acetobacteraceae, Nitrosomonadales |

Nitrogen cycle:

|  |  |  |
| --- | --- | --- |
|  | ME | TB |
| Nitrification | None | Methylococcales |
| Denitrification | None | Methylococcales, Heliocobacterales |
| Nitrate reduction (assimilatory) | Cyanobacteria | Verrucomicrobiales, Campylobacterales, Burkholderiales |
| Nitrate reduction (dissimilatory) | Unclassified, Rhodocyclaceae | Burkholderiales, Holophagales, Desulfuromonadales |
| Nitrogen fixation | Cyanobacteria | Chlorobiales, Holophagales, Campylobacterales, Burkholderiales, Verrucomicrobiales, Methylococcales, Solirubrobacterales, Desulfobacterales, Desulfuromonadales, Bacteroidales, Elusimicrobiales |
| Polyamines (putrescine, spermidine) | Deltaproteobacteria, Verrucomicrobia, Planctomyces, Rhodocyclaceae, Methylococcales, Sphingobacteriales, Cytophagales, Tenericutes, Cyanobacteria, unclassified, Acidimicrobiales, Flavobacterales, Burkholderiales | Methylococcales, Verrucomicrobia, Holophagales, Chlorobiales, Campylobacterales, Bacteroidales, Bdellovibrionales, Sphinogbacteriales, Alphaproteobacteria, Bacteroidales, Ignavibacteria, Rhizobiales, Burkholderiales |

Sulfur cycle:

|  |  |  |
| --- | --- | --- |
|  | ME | TB |
| Sulfur reduction (assimilatory) | Planctomyces, Mycobacteraceae, Cyanobacteria, Verrucomicrobia, Sphingobacterales, unclassified, Acidimicrobiales, Rhodocyclaceae, Methylophilales, Methylococcales, Chloroflexi, Sphingomonadales, Chlamydiales, Burkholderiales, Xanthomonadales | Methylococcales, Verrucomicrobia, Burkholderiaceae, Chlorobiales, Methylophilaceae, Acidimicrobiaceae, Actinobacteria, Solibacterales, Helicobacteracaea, Sphingobacterales, Holophagales, Geobacteraceae, Ignavibacteriaceae, Bacteroidales |
| Sulfur reduction (dissimilatory) | None | Gallionellaceae, Desulfobacterales |
| Sulfide oxidation | Burkholderiales, Planctomyces, Rhodocyclaceae, Methylophilales, Acidimicrobia, Actinomycetales | Methylococcales, Burkholderiales, Chlorobi, Methylophilaceae, Actinobacteria, Holophagales, Helicobacteraceae, Sphingobacterales, Gallionellaceae, Solirubrobacterales, Ignavibacteraceae, Bacteroidales, Nitrosomonadales, Gammaproteobacteria |

Figure 1. Compare/contrast carbon cycling by lake

Figure 2: Compare/contrast sulfur cycles

Figure 3. Compare/contrast nitrogen cycles

Figure 4, 5, and 6. 3 weird genomes (Elusimicrobia, Planctomyces, Tenericutes, Helicobacter, unclassified mini genome?)

Figure S1. Community composition of metagenomes

Table S1. List of genomes and traits

Table S2. ANI matrix

What to put in weird genome diagrams?

* Tenericutes – super complex carbon diagrader, motile w/ chemotaxis
* Helicobacter as a primary producer
* Elusimicrobia – complex carbon degradation
* The small unclassified genomes don’t have enough going on
* Lots of different Planctomyces with not unusual functions.