Published growth rates of anaerobic methane oxidizers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ecosystem | Method | Taxa info | Incubation temperature | Growth rate | Authors |
| Deep sea sediment samples | 15N labeling | Sulfate-dependent | 28-37C | Significant 15N amino acid labeling in 3 weeks, doubling time 2-3.4 months | Kruger 2008 |
| Hydrocarbon cold seep sediments | Cell density estimation over time in bioreactor | ANME-2c methanotrophs | 5C | 0.167/week,  **0.024/day**  29 day incubation | Girguis 2005 |
| Hydrocarbon cold seep sediments | Cell density estimation over time in bioreactor | ANME-1 methanotrophs | 5C | 0.121/week,  **0.017/day**  40 day incubation | Girguis 2005 |
|  | Sequencing batch reactor | N-DAMO | 30C | **0.0277/day** (0.1939/week) | He 2013 |
|  | Bioreactor with enrichment culture | N-DAMO  Candidatus Methylomirabilis lanthanidiphila | 30C | Max: **0.14/d** (0.98/week) doubling time of 5 days | Guerrero-Cruz 2019 |
| Deep sea sediments near mud volcano | Cell counts, FISH |  | ? | **0.003/day** (0.021/week) | Ruff 2019 |
| Deep sea sed near methane hydrate | culture | S-DAMO | 4-16C | **0.003/day** | Nauhaus 2007 |

Published growth rates of aerobic methane oxidizers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ecosystem | Method | Taxa info | Incubation temperature | Growth rate | Authors |
| Upland aerobic soil | qSIP |  | 20C | 0.032/day (0.224/week)  15-35 day incubation | Data from Bruce |
| **Arctic peat bogs** | culture | Methylococcales | 20C | **0.8-1/day** (5.6/week) | Dedysh 1998 |
| Arctic peat bogs | Simulated exponential growth in native peat samples to estimate in situ growth rate |  | ? | 0.02/day (0.14/week) | Dedysh 1998 |
| **Arctic peat bogs** | culture |  | 20C | Max: 0.02-0.04/hr (**0.48-0.96/day**)  6-8 weeks | Dedysh 1998 |
| Deep sea sediments near mud volcano | Cell counts, FISH |  | ? | 0.01/day (0.07/week) | Ruff 2019 |
| **Volcanic soil** in Italy | culture | Verrucomicrobia | 35-44C | Max: 0.013-0.04/h  **(0.312-0.96/day)** | Van Teesling (2014) |
| Acidic **FW wetland** 0-5cm | culture | Methylovirgula thiovorans (can oxidize methane and reduced sulfur) | 25C | Max: 0.023/hr (**0.552/day**) | Gwak 2022 |
| Northern FW **wetland** | culture | Candidatus Methylospira mobilis | 20C | Max: 0.049/h (**1.176/day**) | Oshkin 2019 |
| **Tropical topsoil** near natural methane leak 0-5cm | culture | Methylococcaceae | 50C | 0.036/h (**0.864/day**) | Islam 2016 |

Published growth rates of methanogens

(suggested 4-6x higher than ANMO)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ecosystem | Method | Taxa info | Incubation temperature | Growth rate | Authors |
| Alaskan marine sediments | Culture | Methylotrophic | 6C | 0.133-0.322 week (0.019-0.046/day) | D. Boone |
| Anoxic lake sediments |  | Methanosarcina lacustris | 5C | 0.504 week (0.072/day) | Simankova 2001 |
| Ice lake in Antarctica |  | Methanogenium frigidum (hydrogenotrophic) | 5C | 0.7 week (0.1/day) | Franzmann 1997 |
| **Brackish wetland** in Tibet, 20-30cm | Culture | Methanolobus taylorii (methylotrophic) | 18C | 0.063/hr **(1.512/day)** | Zhang 2008 |
| Mud near a hot springs | Culture | hydrogenotrophic | 63-66C | 0.62/hr (14.88/day) | Kitaura 1992 |
| Deep ocean sediments | Culture | Acetoclastic?  Methanoculleus marisnigri | 25-30C but optimal growth is 45C | 0.025-0.04/day (4.2-6.72/week) | Mikucki 2003 |
| **Wetland soil** | Spec/  turbidity of sample | Methyltrophic  Methanomethylovorans | 37C is optimum (25-40C range) | 0.03-0.15/h **(0.72-3.6/day)** | Cha 2013 |
| **Wetland** soil 10-30cm | culture | Methylotrophic | 18C | 0.063/hour (**1.512/day**)  60 day incubation | Jiang 2010 |
| **Wetland** | culture | Hydrogenotrophic | 25C | 0.065/h (**1.56**)  45 day incubation | Zhou 2014 |
| **Wetland** | culture | Hydrogenotrophic | 37C | 0.031/h (**0.744/day**) | Tian 2010 |
| Upland aerobic soil | qSIP |  | 20C | 0.034/day (0.238/week)  15-35 day incubation | Data from Bruce |