

## Order *Freyarchaeales*

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### Etymology

[Fre.y.ar.chae.a'les] N.L. neut. n. *Freyarchaeum*, referring to the type genus Freyarchaeum; *-ales*, ending to denote an order; N.L. fem. pl. n. *Freyarchaeales*, the Freyarchaeum order

### Nomenclatural type

Genus *Freyarchaeum*

### Description

The type species for this taxonomic group were initially reconstructed by manual curation of Illumina short-read assemblies and then validated using both Nanopore and PacBio long reads. Phylogenetic analyses of this fully curated genome using several sets of marker genes placed the complete genomes in a monophyletic group within the Asgard clade as a sister group to Atabayarchaeia. We performed phylogenetic analyses using concatenated marker sets of 47 archaeal clusters of orthologous genes (arCOGs) and 15 ribosomal protein (RP15) gene cluster, as well as the 16S rRNA gene. The new genomes share only <45% AAI when compared to other Asgard genomes, consistent with their assignment to a new phylum. Although our analyses provide evidence for distinction at the phylum level, we chose to adhere to the Genome Taxonomy Database (GTDB) for standardized microbial genome nomenclature. We establish a robust classification and propose Freyarchaeum as the type genus for the family Freyarchaeaceae, the order Freyarchaeales, the class Freyarchaeia with the Asgardarchaeota phylum. Based on protein content and compositional features, we infer that Freyarchaeia is a non-methanogenic acetogenic chemoheterotroph, with potential to grow lithoautotrophically by using H<sub>2</sub> as an electron donor. This lineage was originally reconstructed and named from Guaymas Basin, located in the Gulf of California, México, and from Jinze Hot Spring (Yunnan, China). Subsequently, another group used the original data to recover similar genomes and referred to them as Jordarchaeia. Here, we retain the original nomenclature.

### Classification

*Archaea* » *Asgardarchaeota* » *Freyarchaeia* » *Freyarchaeales*

### References

Effective publication: Valentin-Alvarado et al., 2024 [1]

### Registry URL

<https://seqco.de/i:48236>

## References

1. Valentin-Alvarado et al. (2024). Asgard archaea modulate potential methanogenesis substrates in wetland soil. *Nature Communications*. DOI:10.1038/s41467-024-49872-z