

Genomic insights into energy metabolism of *Carboxydocella thermautotrophica* coupling hydrogenogenic CO oxidation with the reduction of Fe(III) minerals

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Running title: *Carboxydocella thermautotrophica* genomes

SUPPLEMENTARY MATERIAL

(Table S4, Figures S1-3)

Supplementary Table S1. The distribution of hits to COG functional categories in the genomes of *C. thermautotrophica* strains.

Presented as a separate MS Excel file.

Supplementary Table S2. *Carboxydocella thermautotrophica* Wood-Ljungdahl pathway enzymes and, shadowed, enzymes indicative of acetogenesis, particularly, H₂-dependent acetogenesis.

Presented as a separate MS Excel file.

Supplementary Table S3. *Carboxydocella thermautotrophica* multiheme cytochromes.

Shadowed are predicted NrfAH-type nitrite-reductase complexes, highlighted yellow is the putative terminal Fe(III)-reductase of strain 019, CFE_2239, highlighted green are multiheme cytochromes encoded in the same locus with CFE_2239.

Presented as a separate MS Excel file.

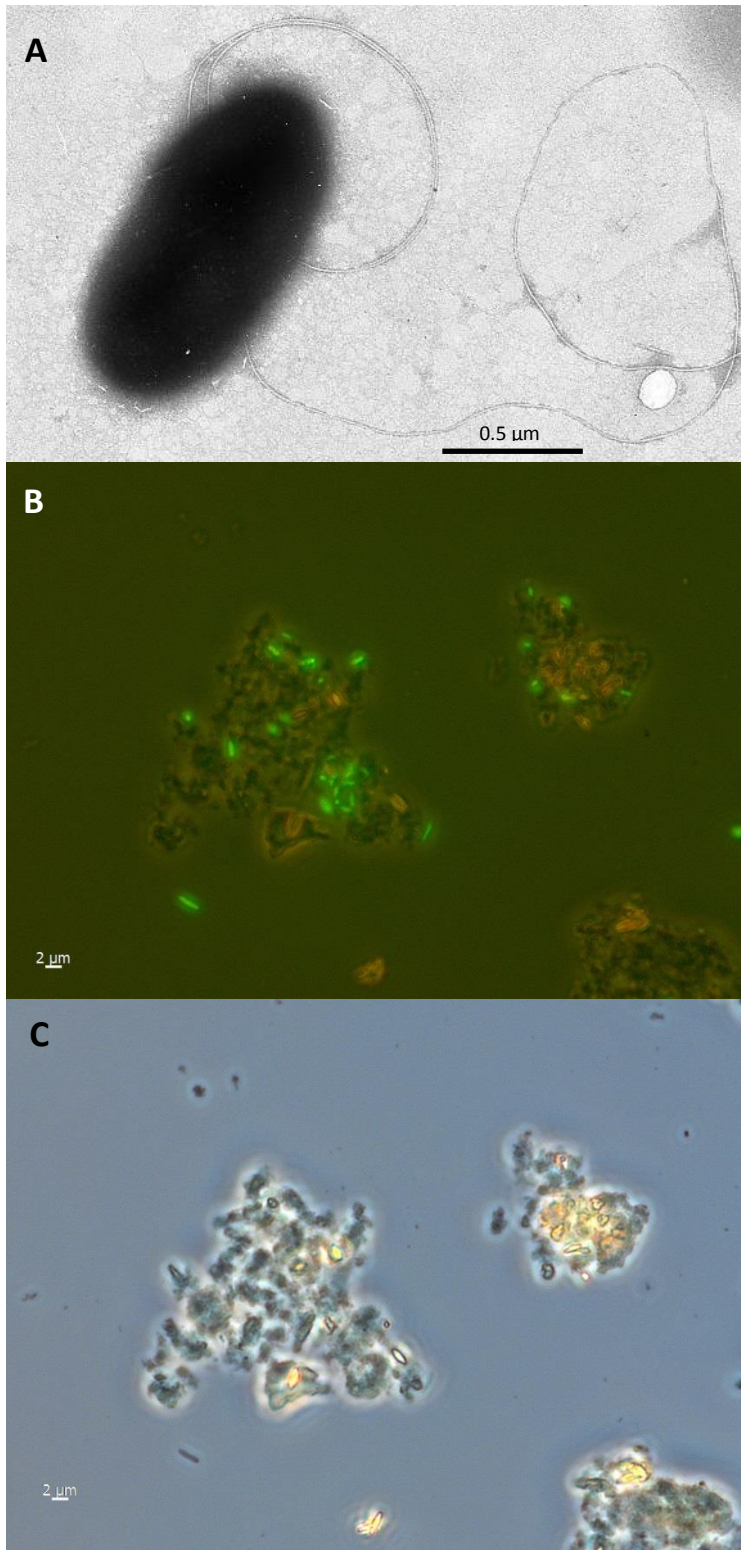
Supplementary Table S4. Key metabolic features of validly described *Carboxydocella* species.

Characteristics	<i>C. thermautotrophica</i> 019	<i>C. thermautotrophica</i> 41 ^T	<i>C. sporoproducens</i>	<i>C. manganica</i>
Genomic DNA G+C content (mol%)	49.1	49.1	49.5	50.9
Hydrogenogenic carboxydotrophy	+	+	+	-
Electron acceptors				
Mn(IV)	-	-	-	+
Fe(III)	+	-	+	+
KNO ₃	-*	-*	-	-
Electron donors				
yeast extract	+	-	+	+
peptone, tryptone	-	-	-	+
molecular hydrogen	-	-	-	+
formate	-	-	-	+
lactate	+	-	+	+
acetate	+	-	-	-
pyruvate	+	-	+	+
glucose	+	-	+	+
sucrose	-	-	-	+

* – nitrate inhibits autotrophic growth but neither inhibits nor stimulates growth with lactate under 100% CO

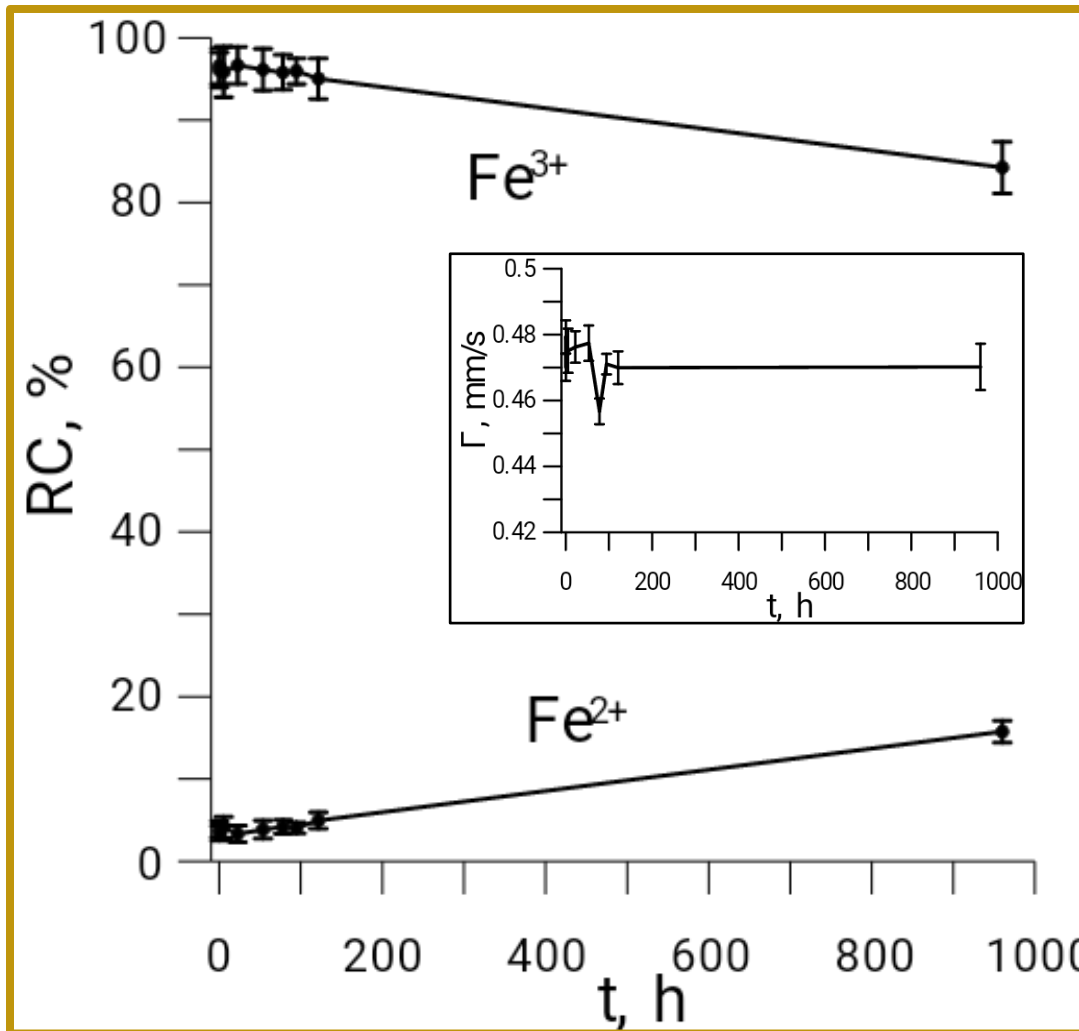
Supplementary Figure S1. Microphotographs of *C. thermautotrophica* strain 019.

A - TEM image of a cell, B –fluorescent image of acridine-stained cell aggregate on magnetite crystals in stationary-phase iron reducing culture, C – phase contrast image of B.



Supplementary Figure S2. The relative intensities of subspectra corresponding to different iron atom positions in glauconite in the culture of *C. thermautotrophica* 019 grown with CO and lactate.

Inlay - The spectral line width dependence on cultivation time.



Supplementary Figure S3. Condensed phylogenetic tree of the N-terminus of the putative Fe(III) reductase CFE_2239 of *C. thermautotrophica* strain 019.

The tree was constructed by Maximum Likelihood method using MEGA6 (Tamura et al., 2013) at default parameters after aligning sequences with built-in Muscle (default parameters). The original tree was condensed using 40% bootstrap cut-off value in MEGA6.

