

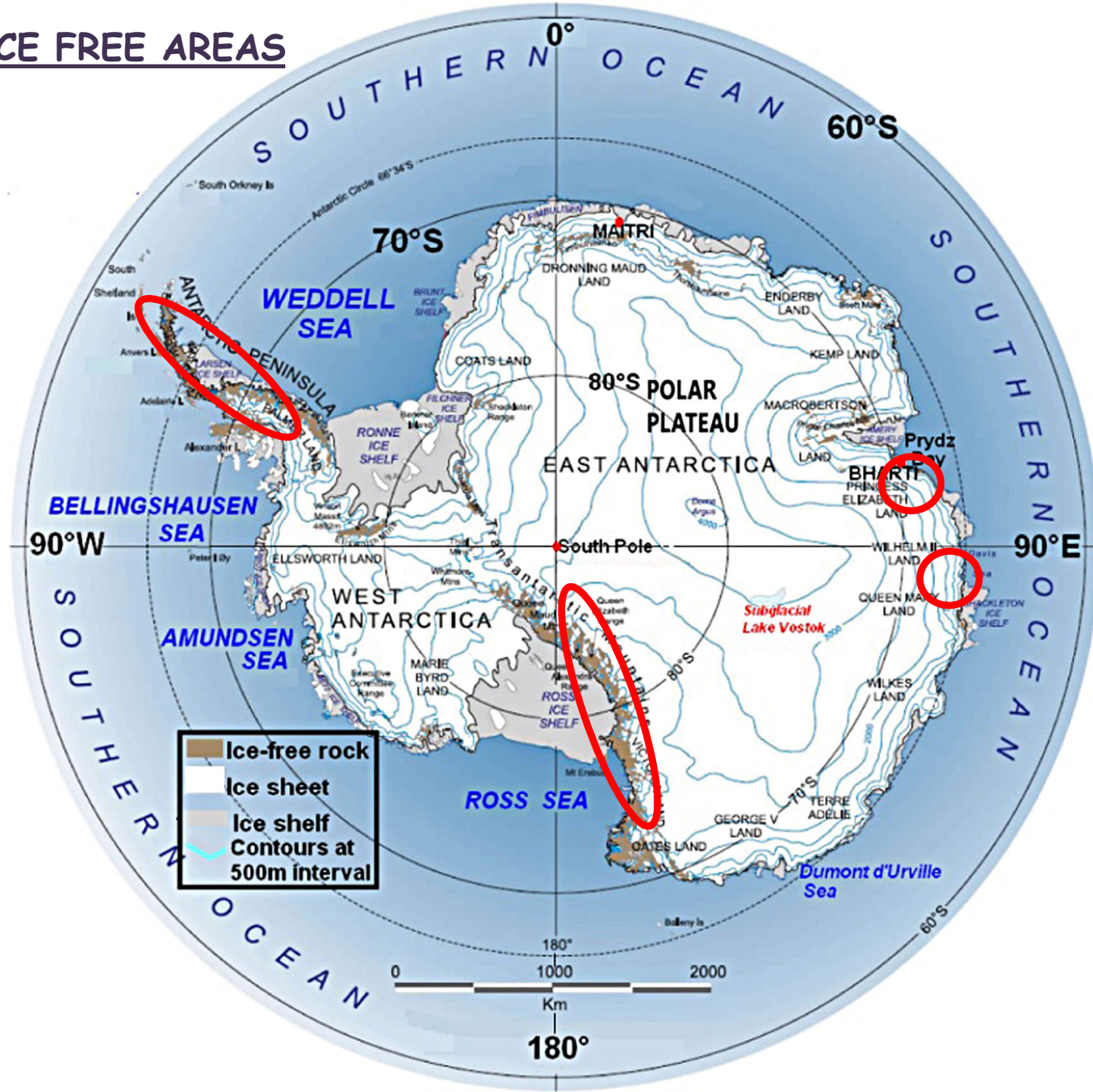


First metagenomic survey into the cryptoendolithic communities of ice-free areas of Continental Antarctica

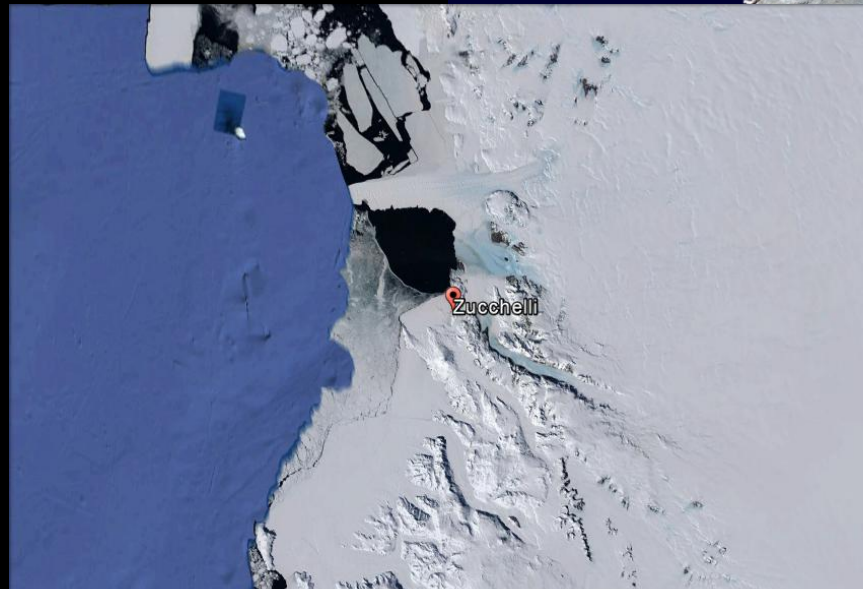
C. Coleine, J.E. Stajich, C. Donati, D. Albanese, L. Zucconi, S. Onofri, C. Pennacchio, S. Tringe, L. Selbmann

XXXVIII Annual Meeting of the European Culture Collections' Organisation, Turin 12-14 June

MAIN ICE FREE AREAS



Inner sites of the Victoria Land



Nunatak



McMurdo Dry Valleys



Mountain peaks

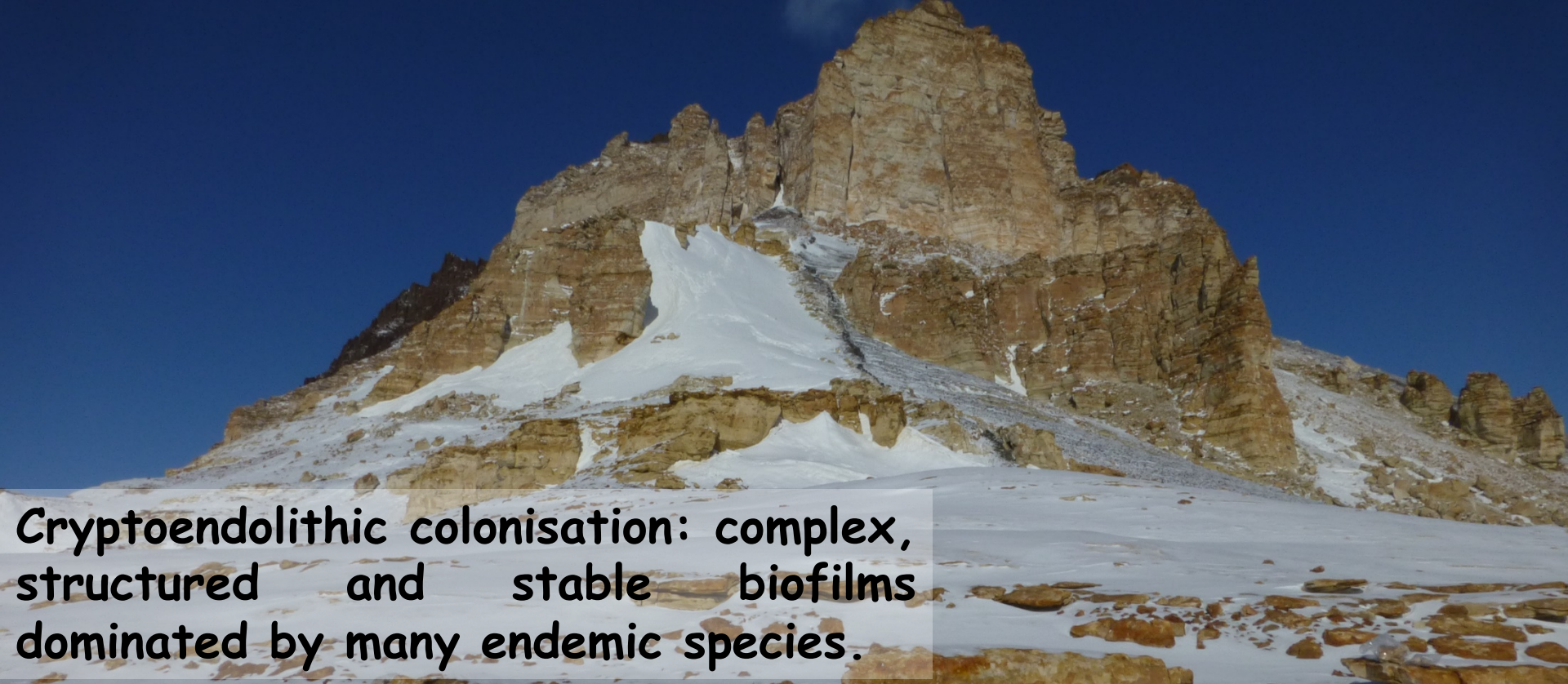


Oldest, coldest, driest and most oligotrophic microbial niches.



Considered life free until 4 decades ago.





Cryptoendolithic colonisation: complex, structured and stable biofilms dominated by many endemic species.



Fragility of these ultimate niches + high adaptation of microbes:

Communities very susceptible to physical and climatic deterioration.

Warming:

- shift in community composition and biodiversity
- introduction of non-native microbial species



Borderline life-style - answer main questions:



- Responses to external perturbations (climate change)
- Explore the limits of adaptability for life (life/extinction)
- Define the limits of habitability in Mars-like environments

- ✓ Microbial biodiversity, community composition and functionality, still poorly understood.
- ✓ Any prediction on the influences of future environmental changes remains speculative.



SAMPLING XXXI Italian Antarctic Expedition

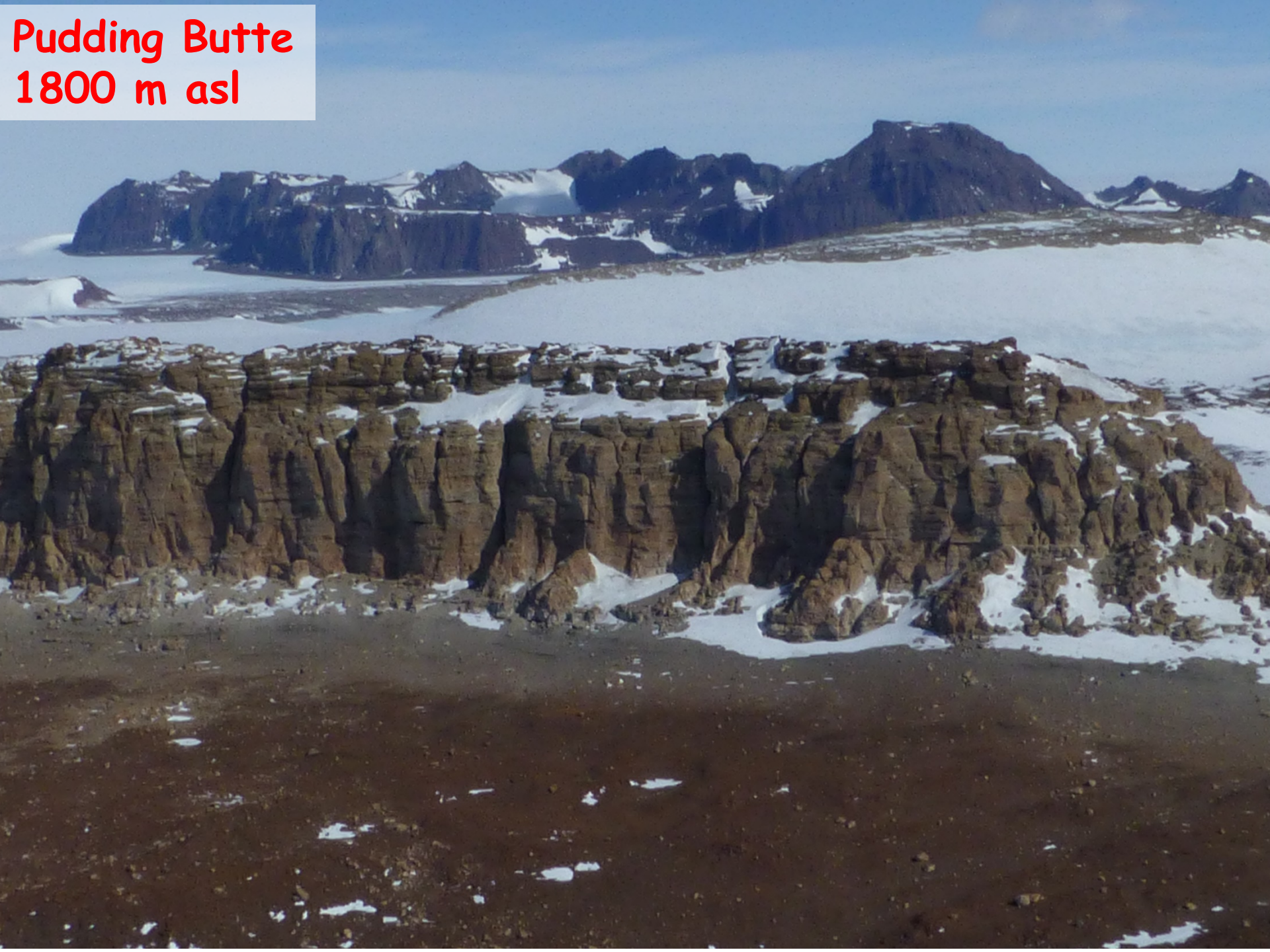
(from 77°54'S 161°34'E to 74°10'S 162°30'E)



Battleship Promontory 800 m asl



pudding Butte
1800 m asl



Mt New Zealand 3200 m asl





Museo Nazionale dell'Antartide

Felice Ippolito



MUSEO

SCOPRI L'ANTARTIDE

SCUOLE

DIDATTICA E DIVULGAZIONE

COLLEZIONI

BIBLIOTECA

CONTATTI

LOGIN

Active since
1996



Sedi

Il Museo Nazionale dell'Antartide è articolato su tre sedi:

- La sede di **Genova** ha il compito di curare la conservazione del materiale biologico marino e terrestre e dei campi d'acqua.
- La sede di **Siena** ha il compito di curare la conservazione del materiale mineralogico, litologico (terrestre ed extraterrestre) e glaciologico.
- La sede di **Trieste** ha il compito di curare la conservazione della documentazione generale e specifica sulla storia dell'esplorazione in Antartide e del materiale sedimentologico marino.

Per la cura di reperti che necessitano di particolari condizioni per la loro conservazione sono state istituite alcune sedi associate presso le Università di Messina, Trieste, Genova, **Tuscia**, Milano Bicocca, CNR Bologna.



2006 - University of Tuscia – Mycological Section Antarctic National Museum

Culture
Collection of
Fungi from
Extreme
Environments



Antarctic Cryptoendolithic Fungal Communities Are Highly Adapted and Dominated by Lecanoromycetes and Dothideomycetes

Claudia Coleine^{1,2}, Jason E. Stajich^{2*}, Laura Zucconi¹, Silvano Onofri¹, Nuttapon Pombubpa², Eleonora Egidi³, Ashley Franks^{4,5}, Pietro Buzzini⁶ and Laura Selbmann^{1,7}

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Article

Sun Exposure Shapes Functional Grouping of Fungi in Cryptoendolithic Antarctic Communities



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Microbiology
Resource Announcements

Draft Genome Sequence of an Antarctic Isolate of the Basidiomycete Yeast Fungus *Exophiala mesophila*

Claudia Coleine,^a Laura Selbmann,^{a,b} Sawyer Masonjones,^c Silvano Onofri,^a Laura Zucconi,^a Jason E. Stajich^c

^aDepartment of Ecological and Biological Sciences, University of Tuscia, Viterbo, Italy

^bMycological Section, Italian National Antarctic Museum (MNA), Genoa, Italy

^cDepartment of Microbiology and Plant Pathology, University of California—Riverside, Riverside, California, USA

GENO



AMERICAN
SOCIETY FOR
MICROBIOLOGY

genomeATMnnouncements

Draft Genome Sequences of the Antarctic Endolithic Fungi *Rachicladosporium antarcticum* CCFFEE 5527 and *Rachicladosporium* sp. CCFFEE 5018

Claudia Coleine,^{a,b} Sawyer Masonjones,^b Laura Selbmann,^a Laura Zucconi,^a Silvano Onofri,^a Claudia Pacelli,^a Jason E. Stajich^b
Department of Ecological and Biological Sciences, University of Tuscia, Viterbo, Italy^a; Department of Plant Pathology and Microbiology and Institute of Integrative Genome Biology, University of California, Riverside, Riverside, California, USA^b

CSP approved project ID 503708



JGI JOINT GENOME INSTITUTE
A DOE OFFICE OF SCIENCE USER FACILITY

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Approved Proposals FY19
Approved Proposals FY18
Approved Proposals FY17
Approved Proposals FY16
Approved Proposals FY15

Approved Proposals FY18

Following are the approved user proposals for fiscal year 2018, including CSP, [CSP Small-Scale](#), and [JGI-EMSL FICUS](#).

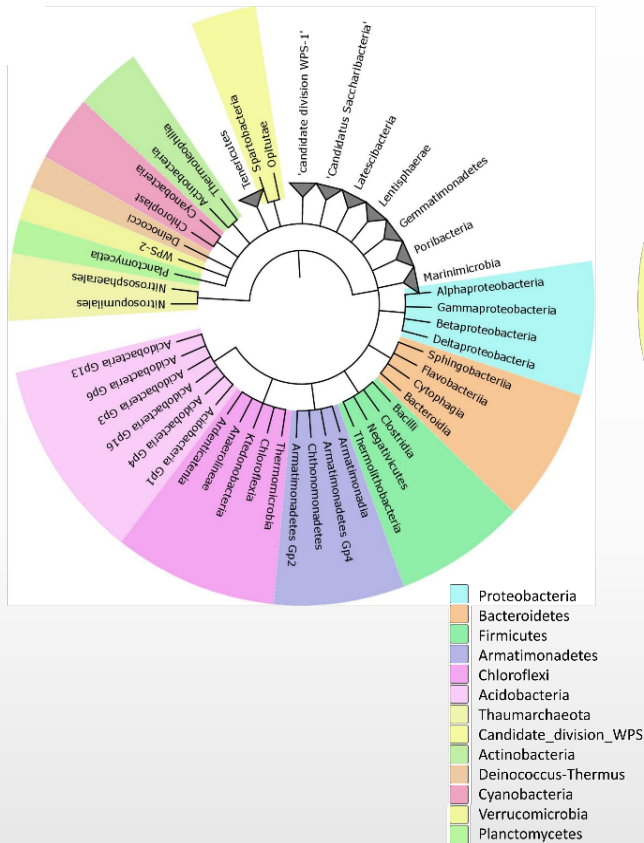
Community Science Program (CSP)

Richardson, Ruth	Cornell University	Metagenomic Exploration of Microbial Communities involved in Carbon and Sulfur Cycling in Two Central New York State Peatlands
Selbmann, Laura	University of Tuscia (Italy)	Metagenomic Reconstruction of Endolithic Communities from Victoria Land, Antarctica
Thamatrakoln, Kim	Rutgers University	The Role of Light and Nutrient Limitation on Algal Host-Virus Interactions in Natural Populations and Subsequent Impacts on Carbon Export and the Biological Pump

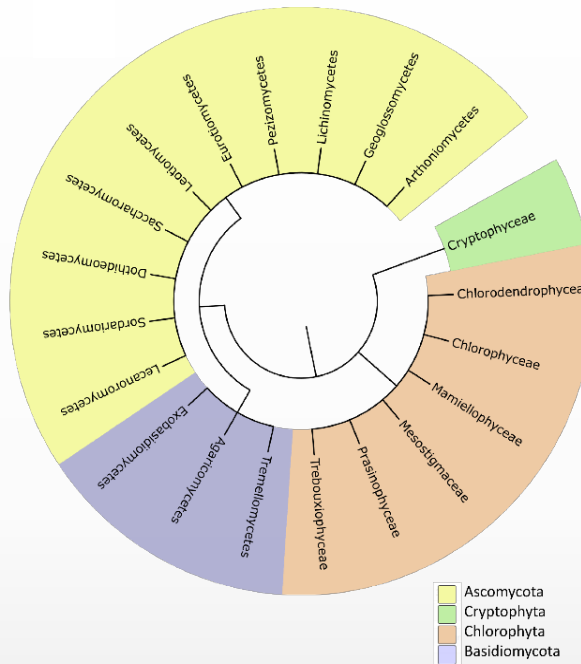
- ✓ Deeply characterize biodiversity and community composition
- ✓ Genome reconstruction of all microbes in the community
- ✓ Functional annotation and prediction of stress- adaptation pathways
- ✓ Database for environmental metagenomes

Taxonomy results

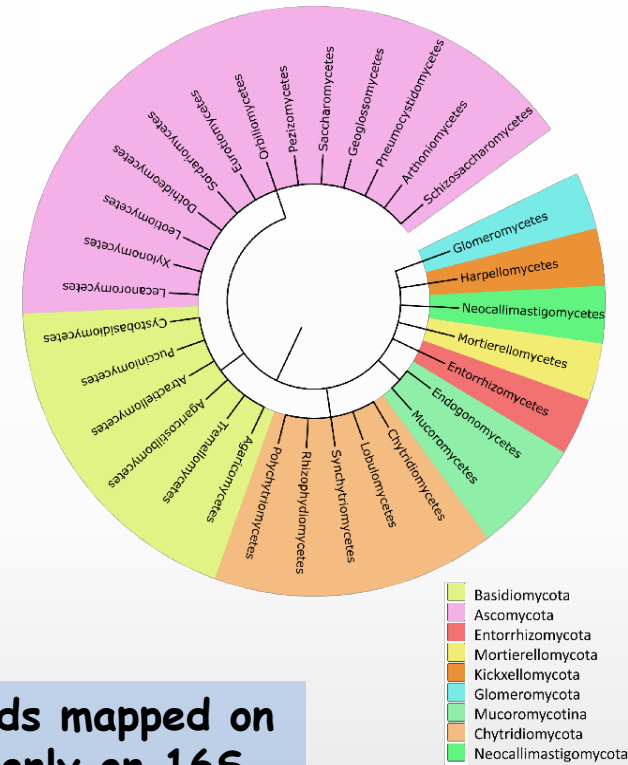
16S Bacteria/Archea



18S Eukaryotes



ITS Fungi



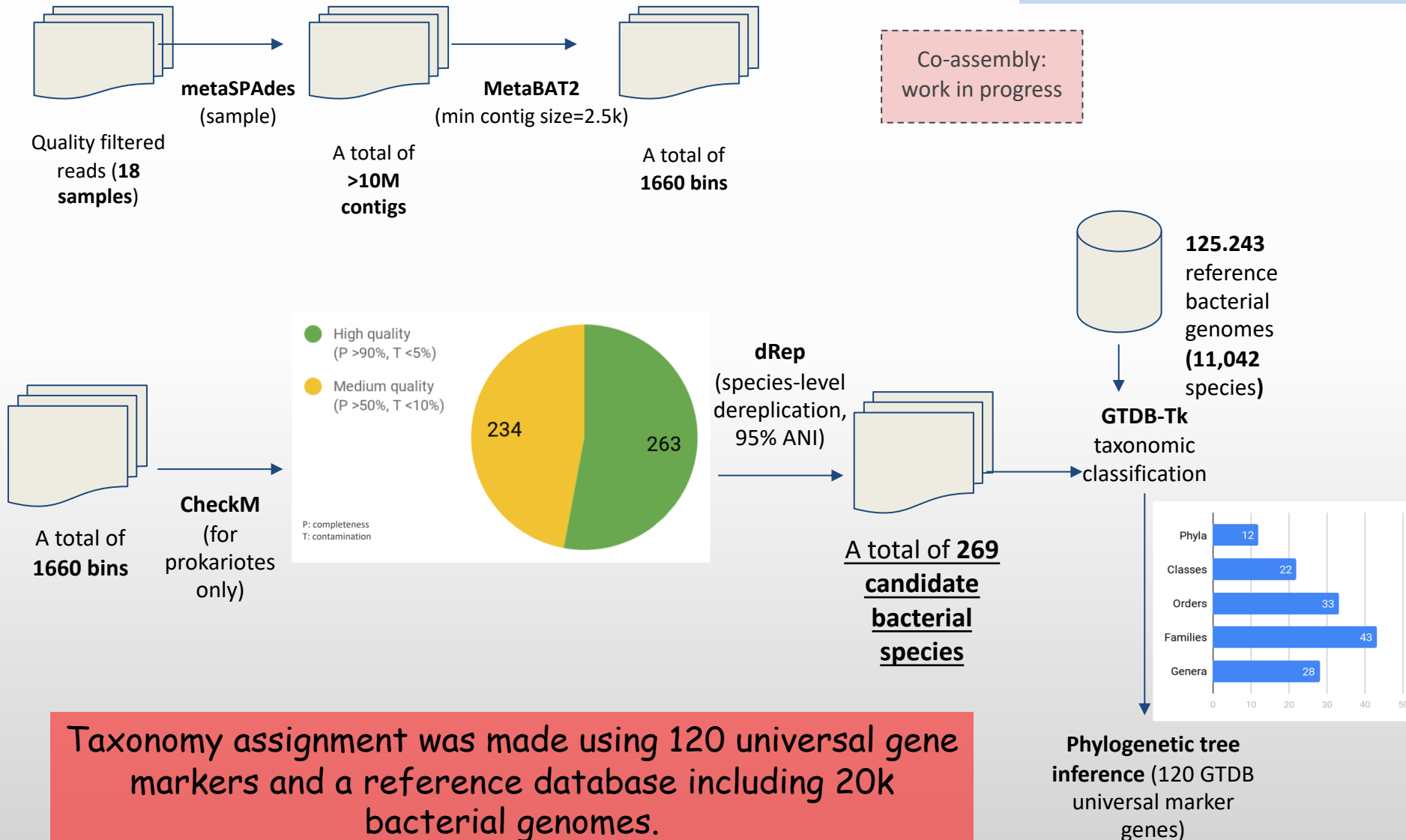
85% of the total reads mapped on 18S and ITS, 15% only on 16S

- Bacterial reads grouped mainly in twenty-one phyla
- Actinobacteria and Proteobacteria dominated
- [Thaumarchaeota](#) among Archaea
- Eukaryotic taxa were dominated by green algae (Trebouxiaaceae and Coleochaetophyceae), lichenized fungi (Class Lecanoromycetes) and dothideomycetous fungi

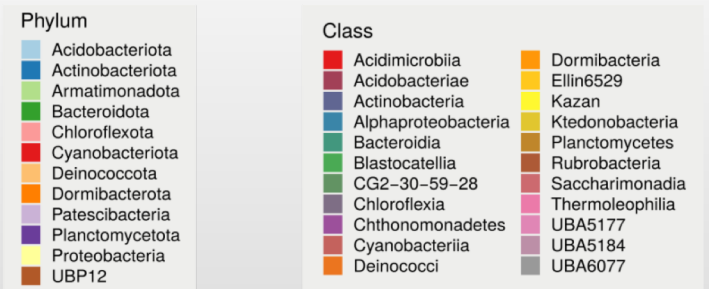
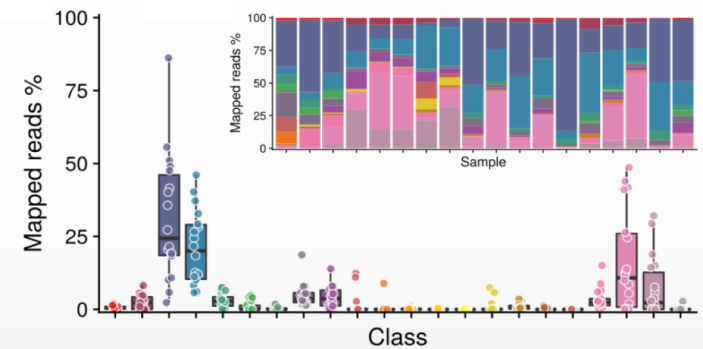
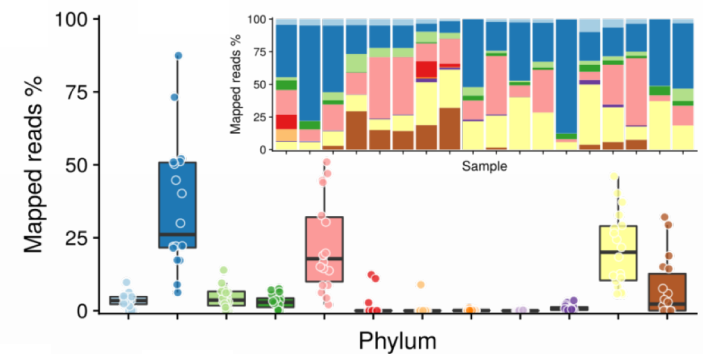
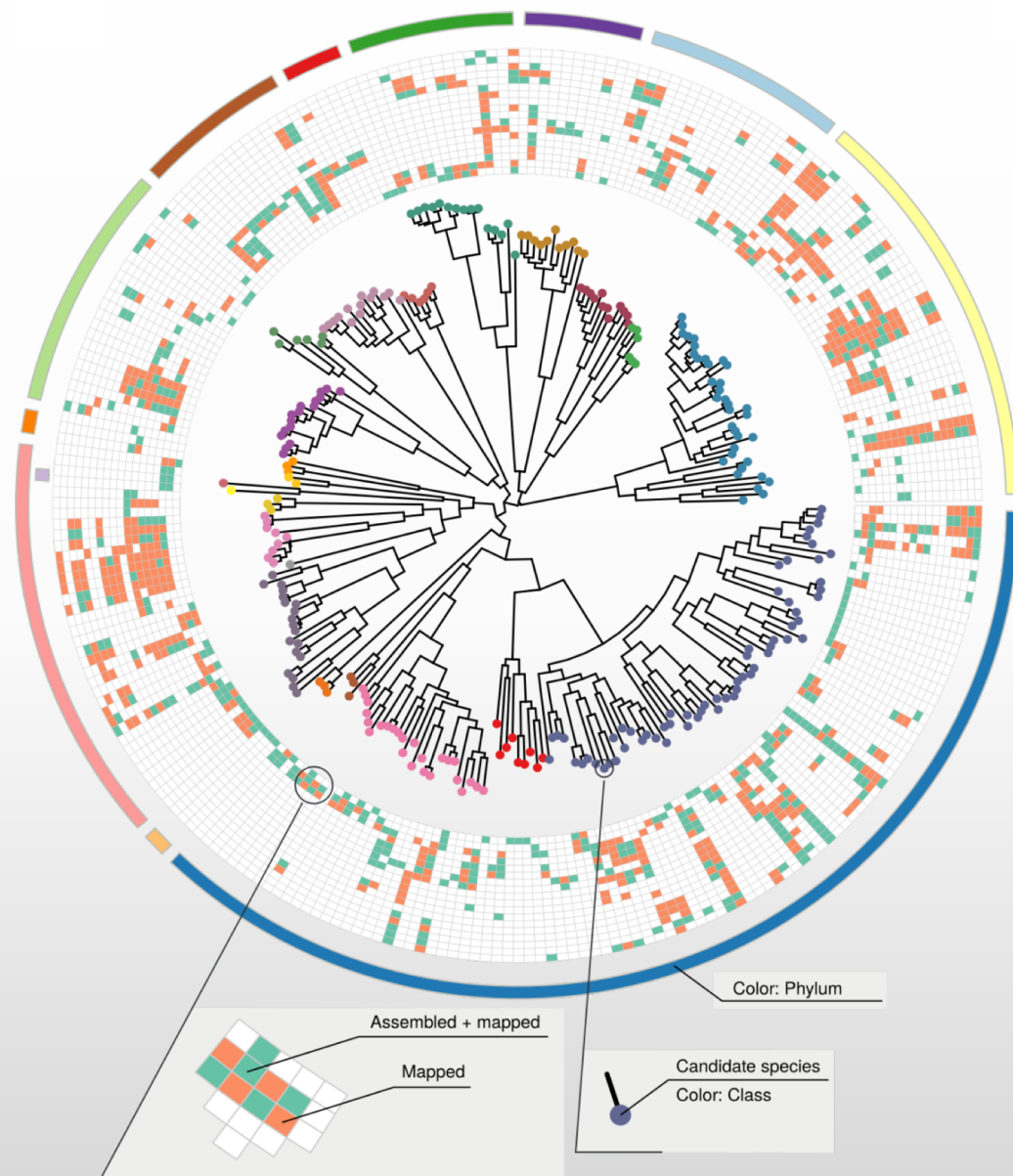
Bacterial OTUs binning

OTU BINNING:
grouping reads and
assigning to Operational
Taxonomic Units

Workflow_assembly and OTU binning



All 269 bins are new genomes, likely new species

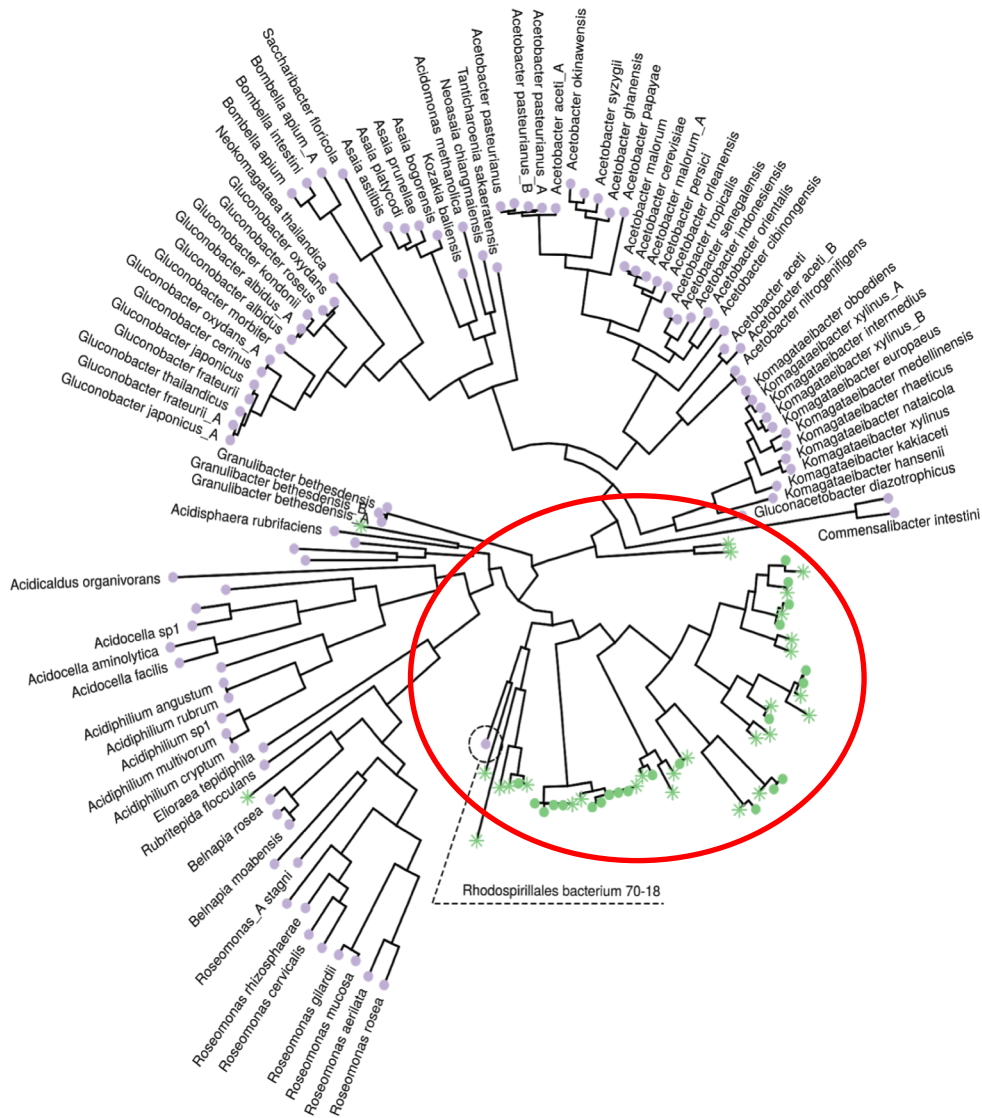


Sample order

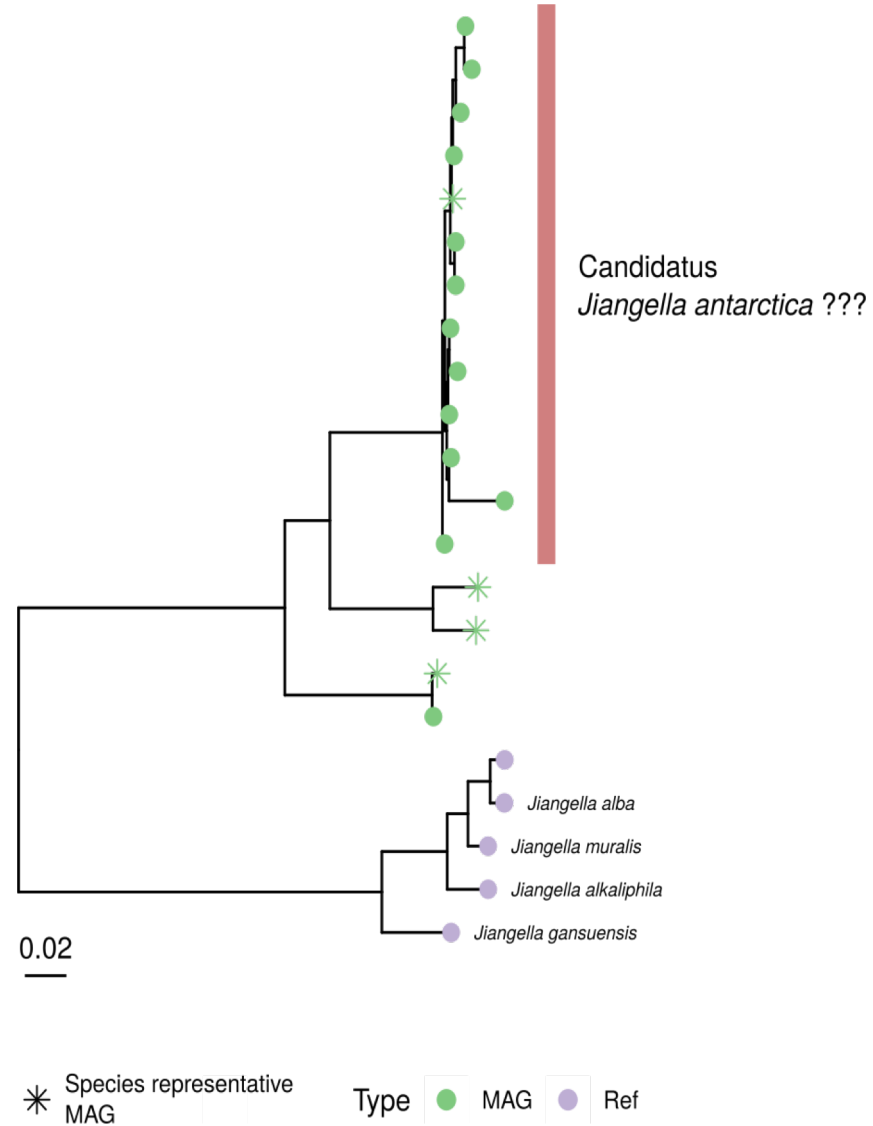
StepPearsonMG₂
RickerHillMG₂
PudPearsMG₂
KnobPearsMG₂
ButtButMG₂
ButtProdMG₂
BalProdMG₂
UnlValProdMG₂
KnobHeadProdMG₂
LinTennProdMG₂
LinNunProdMG₂
FingerNunProdMG₂
FingerNunZordMG₂
RicNunZordMG₂
MNewZordMG₂
FingerNunMG₂
TriNunMG₂
StPearsMG₂

(manus in preparation)

(Acetobacteraceae family)



Jiangellales order



Concluding remarks

- I. Eukaryotes prevail on Prokaryotes
- II. 269 New genomes (likely new species)
- III. All Antarctic clades clustered aside from other genome references i.e. Acidobacteriaceae and Jiangellaceae.

In progress...

- Dating separation of the clades.
- Stress response and adaptation strategies at community and species level.
- Developing bioinformatics tool for Eukaryotes, focusing on Black Fungi.

Future perspectives

JGI's Community Science Program:

"Shed light in The daRk lineagES of the Fungal Tree Of Life (FTOL) "

Acronym: ***STRES***

PI: Laura Selbmann

- I. International Consortium (Culture Collections and 19 Laboratories from Europe, USA, Canada, Mexico, Brazil and China).
- II. Cover all lineages in Dothideomycetes and Eurotiomycetes.
- III. About 100 Black Fungi species as reference genomes and population genomics.
- IV. Metabolomics and transcriptomics to identify the novel enzymes, pathways, and metabolisms enabling Black Fungi to exploit the extremes.
- V. FUNGAL STRESS RESPONSE DATABASE.

'STRES' Consortium



A. Gorbushina
Freie Universität
BAM Collection



G.C. Varese
University of Turin,
MUT Collection



S. de Hoog
DH and Westerdijk
collections



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EXF Collection



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Collection



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K. Sterflinger
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L. Muggia
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- Meritxell Riquelme (Ensenada)
- Nicola Segata (University of Trento)
- Vania Vicente (Universidade Federal do Panamá)
- Allison Walker (Acadia University)



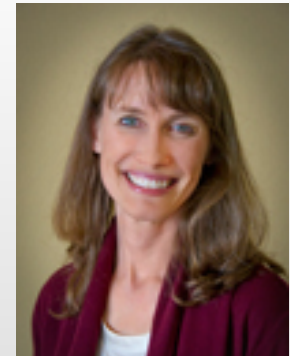
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University of Tuscia (Italy)



Jason E. Stajich,
University of California



Claudio Donati and Davide Albanese, FEM



Susannah Tringe and Christa Pennacchio,
DOE Joint Genome Institute



Mt Elektra, XXXIV Antarctic Expedition 2018-19



Thank you for your attention!

*University of Tuscia -
Mycological Section
Antarctic National Museum*



Culture
Collection of
Fungi from
Extrême
Environments

