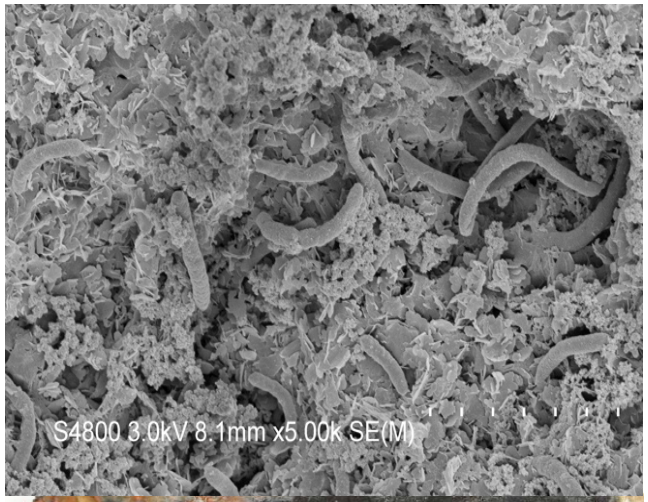


Microbially induced corrosion under repository environments

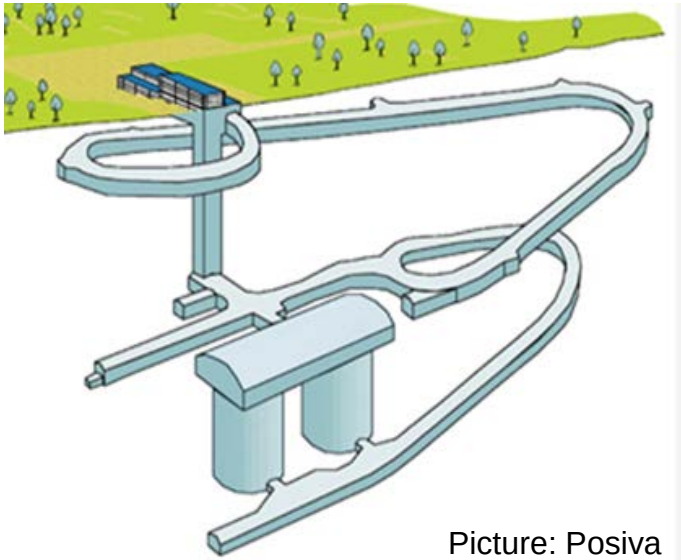
IGD-TP 5th Exchange forum

Kalmar 28.10.2014

Pauliina Rajala, Leena Carpén, Malin Bomberg

LLW/ILW

- Low and intermediate waste is produced during operation and maintenance of nuclear power plants
- Is disposed of in Olkiluoto in concrete boxes into bedrock silos (60 to 100 m depth)
- Most of metallic waste is carbon steel

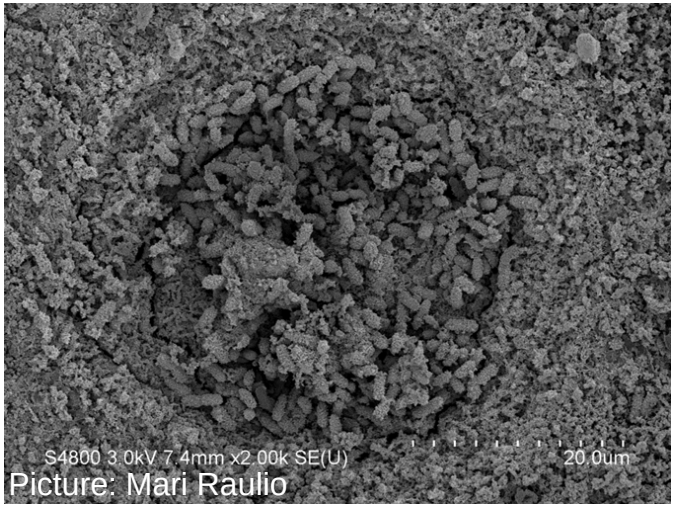


Picture: Posiva

LLW/ILW

- In alkaline and anaerobic environments the corrosion rate of steels is typically low
- Microbiological activity can alter conditions and enable corrosion
- Substantially high corrosion rates have been observed at repository site
    - This has lead to suspicion of microbial role in corrosion

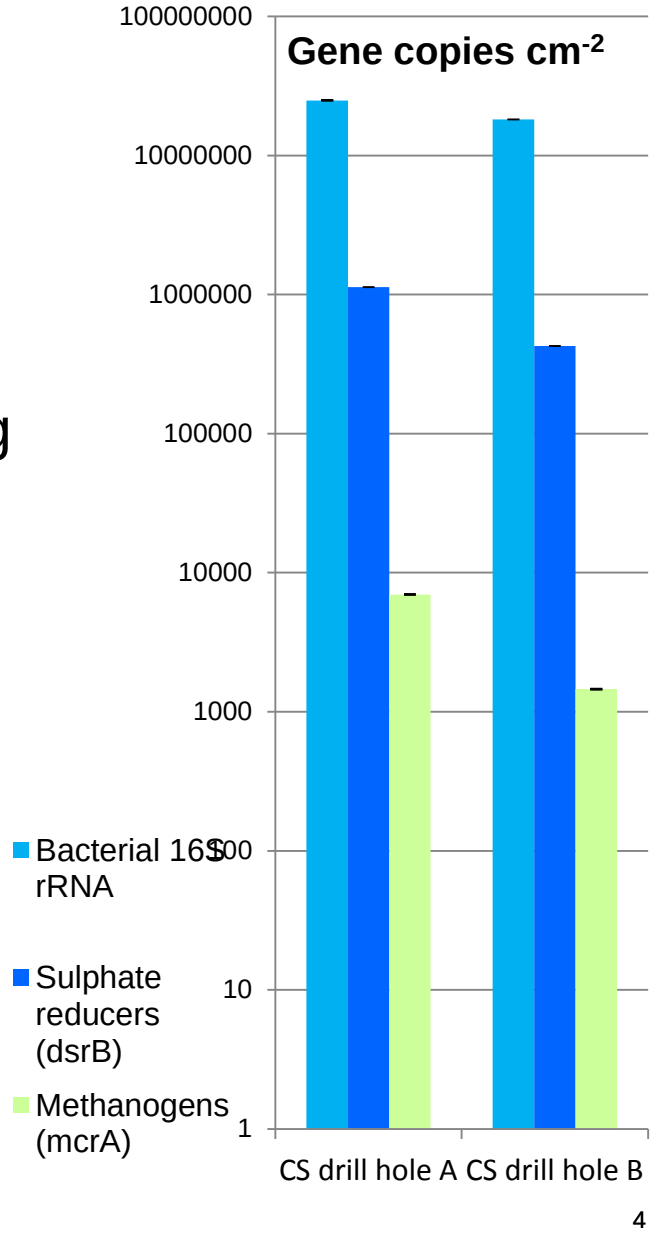
Microbes in corrosion pits on surface of carbon steel



Picture: Mari Raulio

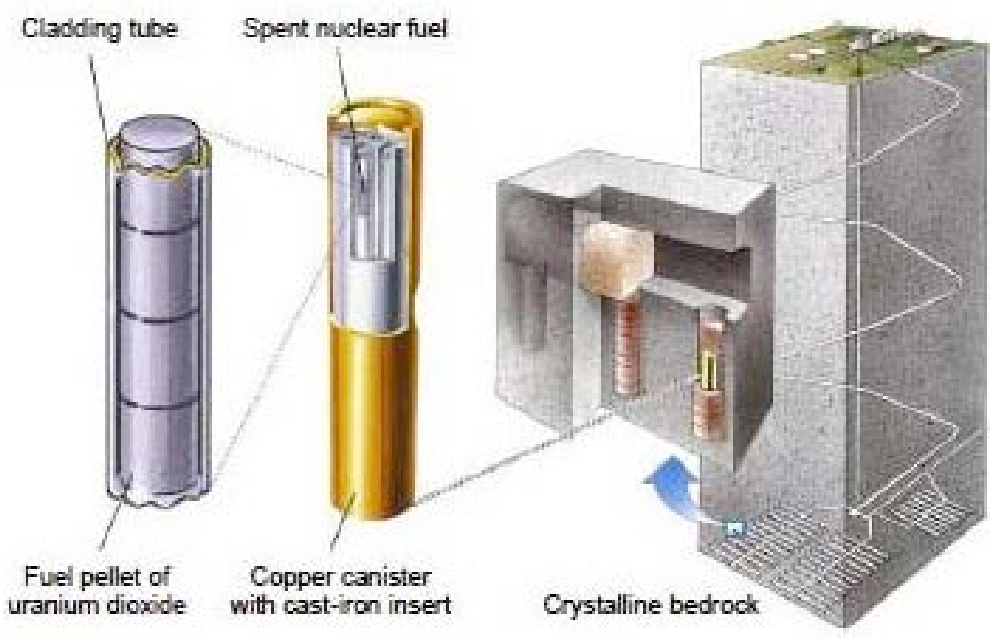
Results

- Average corrosion rates up to 29 µm a^{-1}
- Localized corrosion rates even higher
- Methanogenic archaea and sulphate reducing bacteria enriched on surfaces



HLW

- High level waste is packed in 50 mm thick copper capsule
- Repository depth 500 m

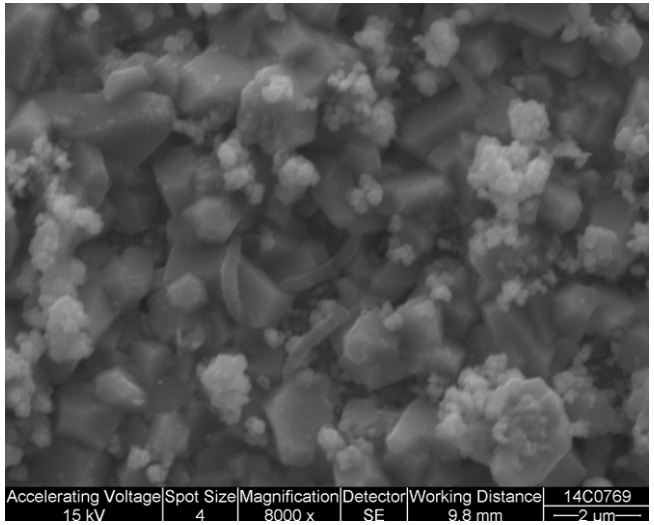


Picture: SKB

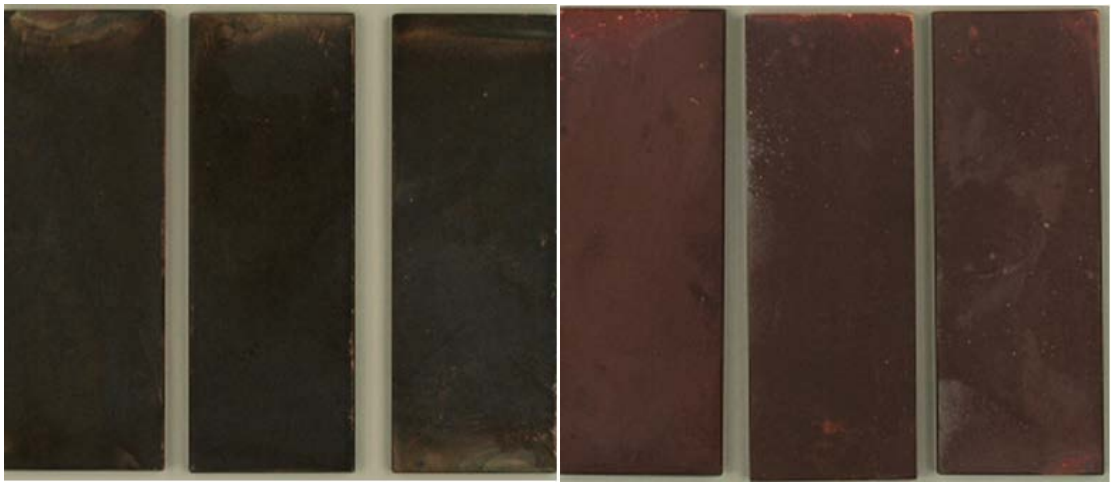
HLW

- Microbial activity may have an affect on the integrity of copper capsule
- Microbial metabolites may enable the stress corrosion cracking or cause general or localized corrosion

Microbes on surface of copper

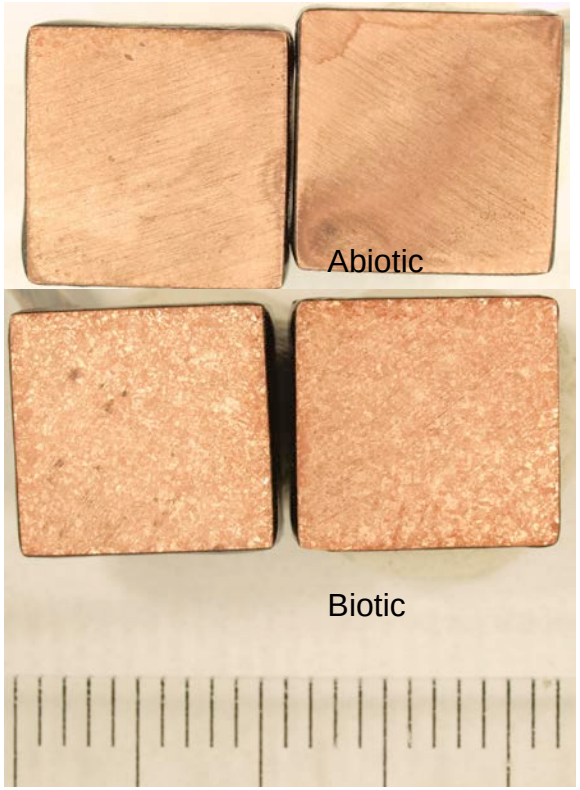


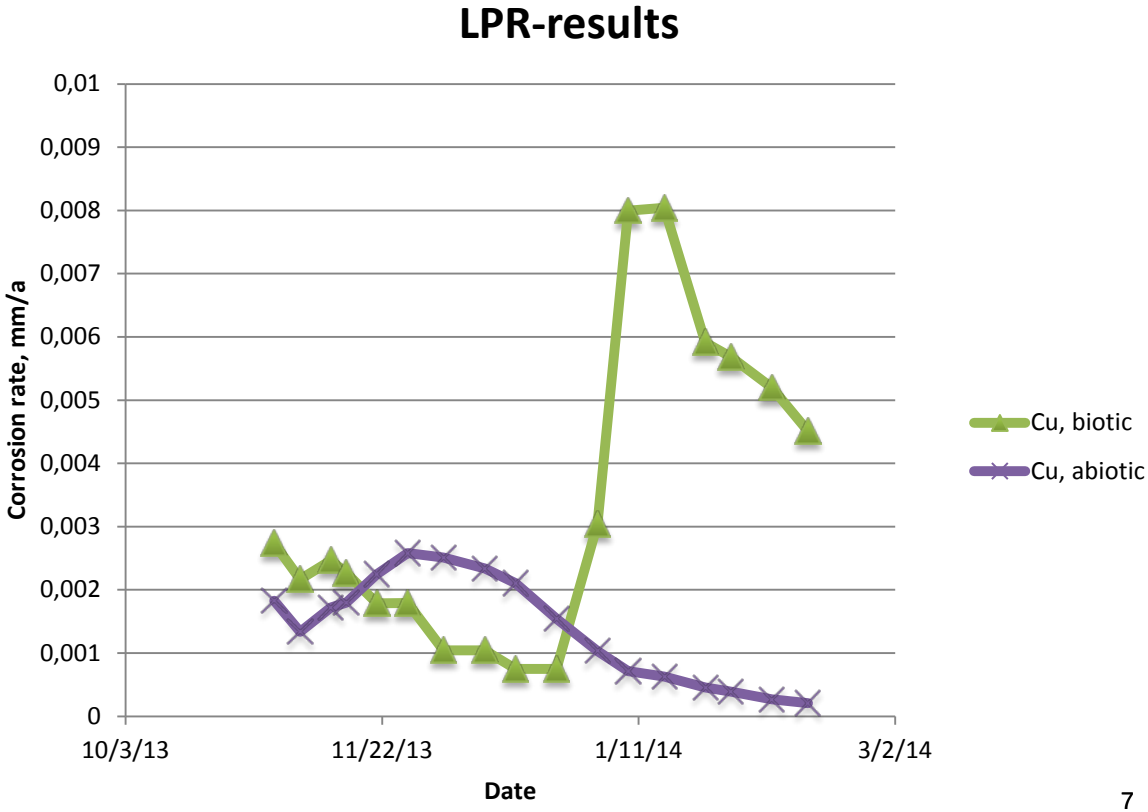
Copper incubated with and without microbes



Results

- The result demonstrate that microbes exhilarate corrosion of copper under simulated repository conditions





Conclusions

- The microbial diversity in natural deep ground water is vast and they are able to adapt changing environmental conditions
- Observed corrosion rates higher when microbes are present

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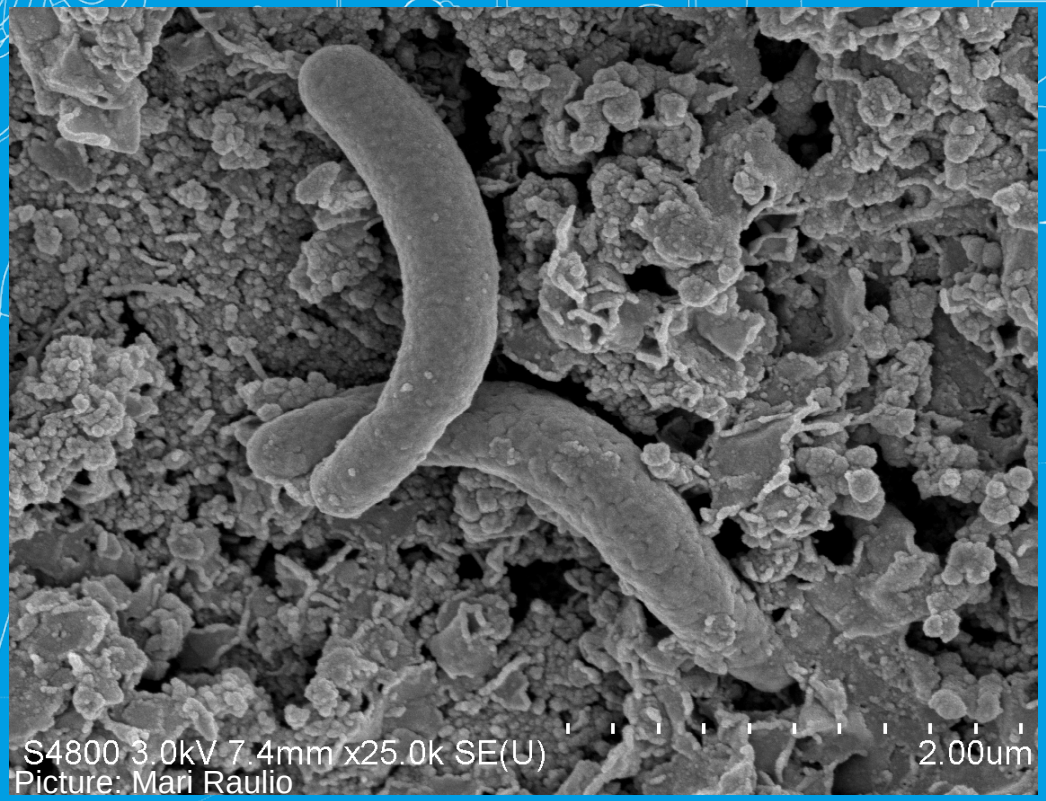

Picture: Mari Raulio