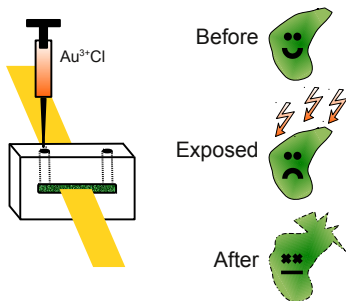


# Economic geology (I)

One way that gold deposits form is by having Au chloride fluids rise from the deep earth, wash over cyanobacteria colonies, and reduce to metallic gold.



We simulated this process at the beamline by exposing cyanobacteria to an  $\text{Au}^{3+}$  solution and “watching” the evolution of the Au XAS from  $\text{Au}^{3+}$  to  $\text{Au}^0$ .

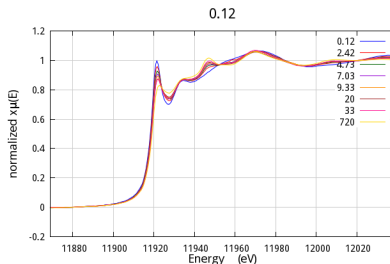
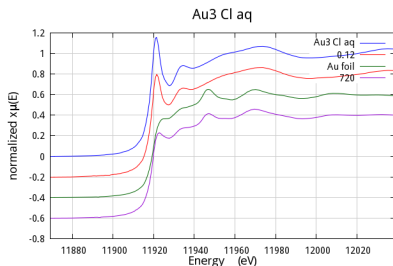
## Questions

- What is the rate constant?
- Is there an intermediate species?

# Economic geology (II)

We see that **7 minutes** after injection, the data strongly resemble the **Au<sup>3+</sup>Cl**. After **one week**, the data resemble **Au metal**.

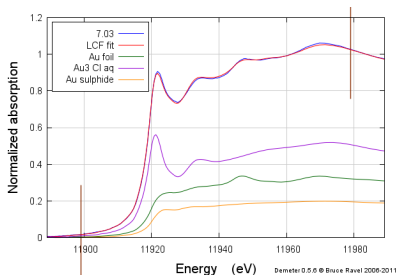
Over the course of the time series, the white line  $\sim 11921$  shrinks while the bump  $\sim 11945$  grows, suggesting the reduction to Au metal.



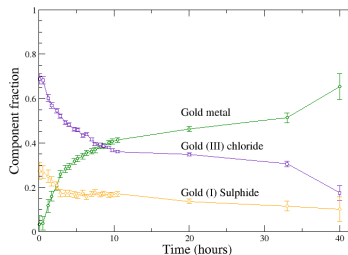
M. Lengke et al., *Mechanisms of Gold Bioaccumulation by Filamentous Cyanobacteria from Gold(III)-Chloride Complex*, Environ. Sci. Technol. **40**(20) p. 6304-6309. (2006), DOI: [10.1021/es061040r](https://doi.org/10.1021/es061040r)

# Economic geology (III)

We can analyze these data as a linear combination of species, including  $\text{Au}^{3+}\text{Cl}$ , Au metal, and  $\text{Au}^{1+}$  sulfide.



We can plot out the contributions from these species as a function of time to get a sense of reaction rates.



M. Lengke et al., *Mechanisms of Gold Bioaccumulation by Filamentous Cyanobacteria from Gold(III)-Chloride Complex*, Environ. Sci. Technol. **40**(20) p. 6304-6309. (2006), DOI: [10.1021/es061040r](https://doi.org/10.1021/es061040r)