How does FIP(2) shine a light on the chemistry of microbial metabolic enzymes

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This presentation will be a story about scientific adventures and scientists that intertwined thanks to BM30A (past) and BM07 (present and future). After a first anecdote of initial contact with BM30A, I will introduce how the beamline contributed to understanding how the [Fe]-hydrogenase catalyzes an important step in methane generation from CO_2. Here, the enzyme-containing a light and O_2-sensitive metallocofactor was directly purified from the native organism and crystallized under strict exclusion of O_2. A first study explained how specialized methanogenic archaea modified the enzyme to protect the metallocofactor upon stress (Wagner, et al. 2018). A second investigation cracked the catalytic mechanism by trapping the enzyme and its substrate (Huang, et al. 2019, Figure 1). The third study explained how the paralog of this enzyme in bacteria evolved substrate specificities to fit metabolic needs (Watanabe, et al. 2019). Most of these structural data benefited from high-quality datasets obtained on BM30A at a time when a careful strategy before data collection mattered.
In 2021, BM07 transcended BM30A. The updated beamline, providing faster and more precise data collection, offered our recent project structures of outstanding quality. I will give a glimpse of the data quality of results obtained from another metallo-containing enzyme used by hyperthermophile methanogens involved in their core metabolism. The future exciting developments of the beamline, such as room temperature data collection, will give a new perspective in the field of the microbial metalloenzymes involved in catabolic reactions, sharpening the image of their active sites and reaction intermediates to transpose their chemistry towards biotechnological application.

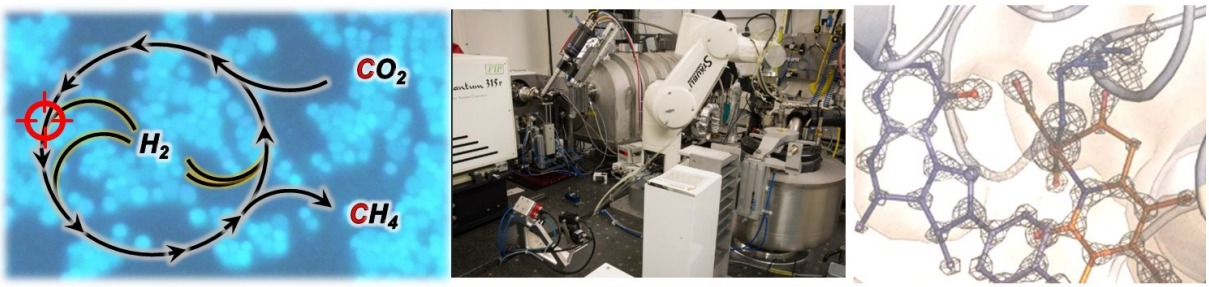

Figure 1: How BM30A helped us to solve the catalytic mechanism of the [Fe]-hydrogenase from a methanogen

1) Wagner T, Huang G, Ermler U, Shima S. *Angew Chem Int Ed Engl*, **2018**, 57:15056-15059.

2) Huang G, Wagner T, Wodrich MD, Ataka K, Bill E, Ermler U, Hu X & Shima S. *Nature Catalysis*, **2019**, 2:537–543.

3) Watanabe T, Wagner T, Huang G, Kahnt J, Ataka K, Ermler U, Shima S. *Angew Chem Int Ed Engl*. **2019**, 58:3506-3510.