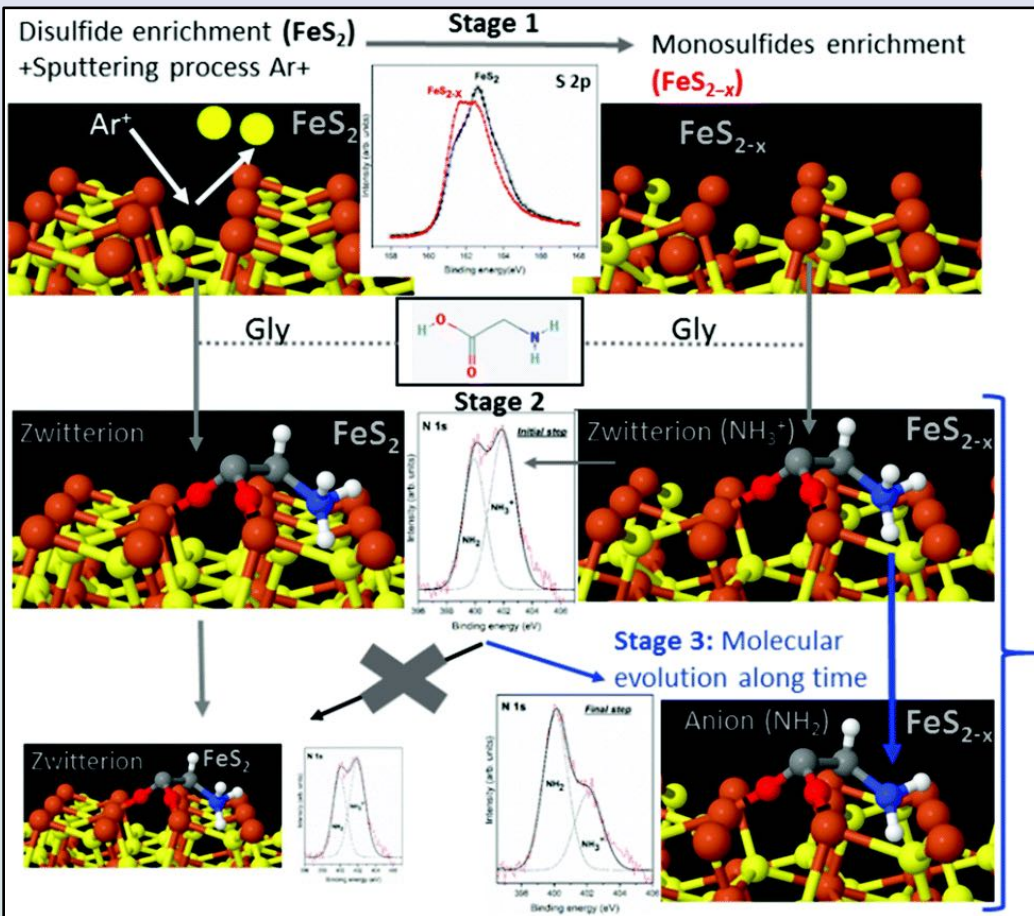


# Defects on a pyrite surface produce chemical evolution of glycine



- In the last 30 years, the studies of iron and sulfur compounds as catalytic systems have revealed great interest in the formation of organic molecules necessary for life. This idea, called “iron-sulfur world hypothesis” postulates that iron sulfides played an important role in prebiotic organic molecules synthesis on early Earth.
- In this study, the presence of sulfur vacancies on pyrite ( $\text{FeS}_2$ ) surface mineral makes it a suitable substrate for driving the chemical evolution of the amino acid glycine (one of most basic building blocks of life) over time. Spectroscopic molecular fingerprints prove a transition process from zwitterionic ( $\text{NH}_3^+$ ) species to anionic ( $\text{NH}_2$ ) species over time on the monosulfide enriched surface. By combining experimental and theoretical approaches, we propose a surface mechanism where the interaction between the amino acid species and the surface will be driven by the loss of neighboring sulfur atoms bounded to iron sites.
- The knowledge of adsorption properties of biomolecules on mineral surfaces will help us understand the role that minerals, acting as catalysts, might have played in prebiotic and surface chemistry, relevant in the emergence of life on early Earth.

**Stage 1:** Generation of defects on pyrite surface  
**Stage 2:** Adsorption of glycine in  $\text{NH}_3^+$  form  
**Stage 3:** Chemical molecular evolution over time from  $\text{NH}_3^+$  form to  $\text{NH}_2$  form due to surface defects. This process is not observed on pristine pyrite