Metallic Copper (Cu[0]) obtained from Cu^{2+}-rich acidic mine waters by two different reduction methods: Crystallographic and geochemical aspects

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Supplemental Material

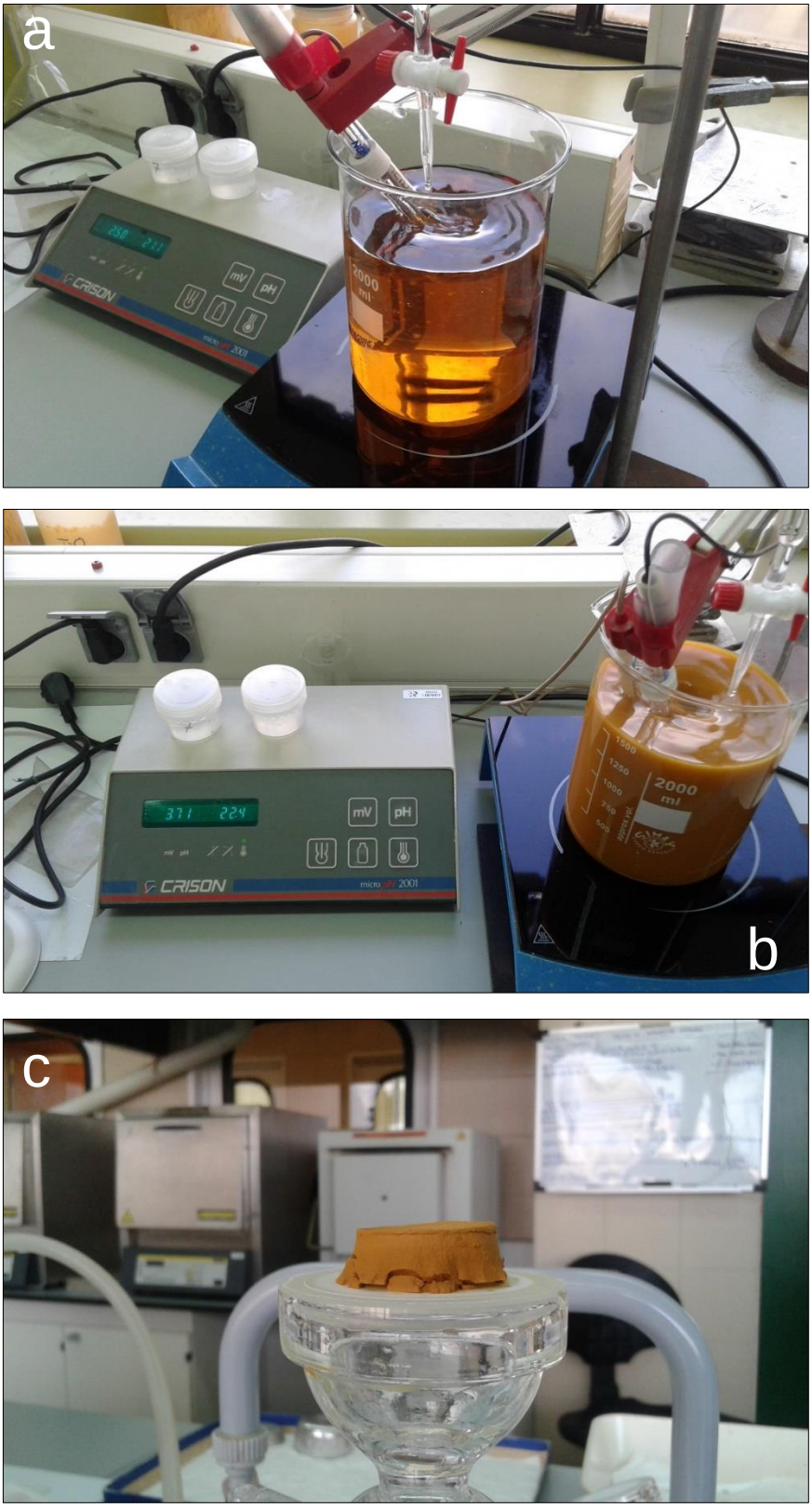


Figure S1. (a) Aspect of the original AMD solution at pH 2.5 before the addition of NaOH. Note the orange-yellowish color of the solution denoting the presence of Fe(III) colloids; **(b)** Dense suspension of Fe(III) precipitates (schwertmannite) formed between pH 2.8 and pH 3.9 during base titration; **(c)** Detail of the Fe(III) precipitate "cake" formed by vacuum tiltration of the neutralized AMD solution shown in b.

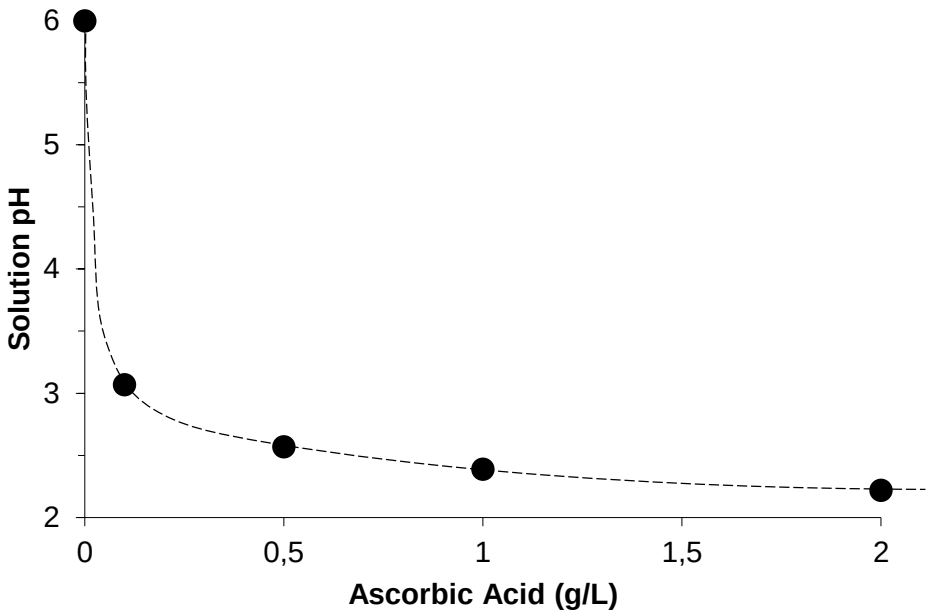


Figure S2. Plot showing the relation between ascorbic acid concentration and pH in the AA solutions prepared for the Cu^{2+} reduction experiments.

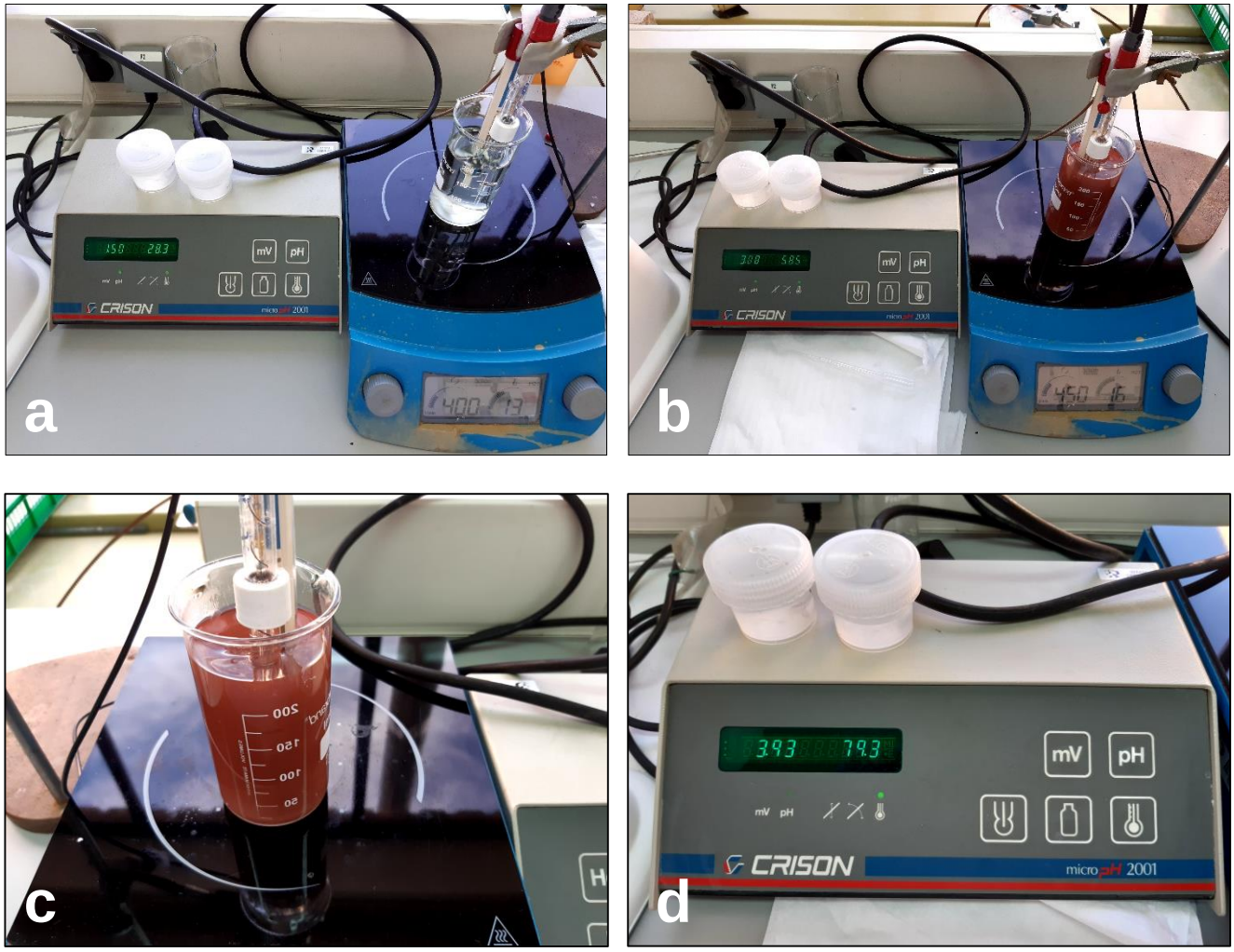


Figure S3. Aspect of the Cu[0] coloidal suspensions formed in the course of the Cu^{2+} reduction experiments with ascorbic acid (10^{-1} M) at pH~3.95 and T~80 ºC.

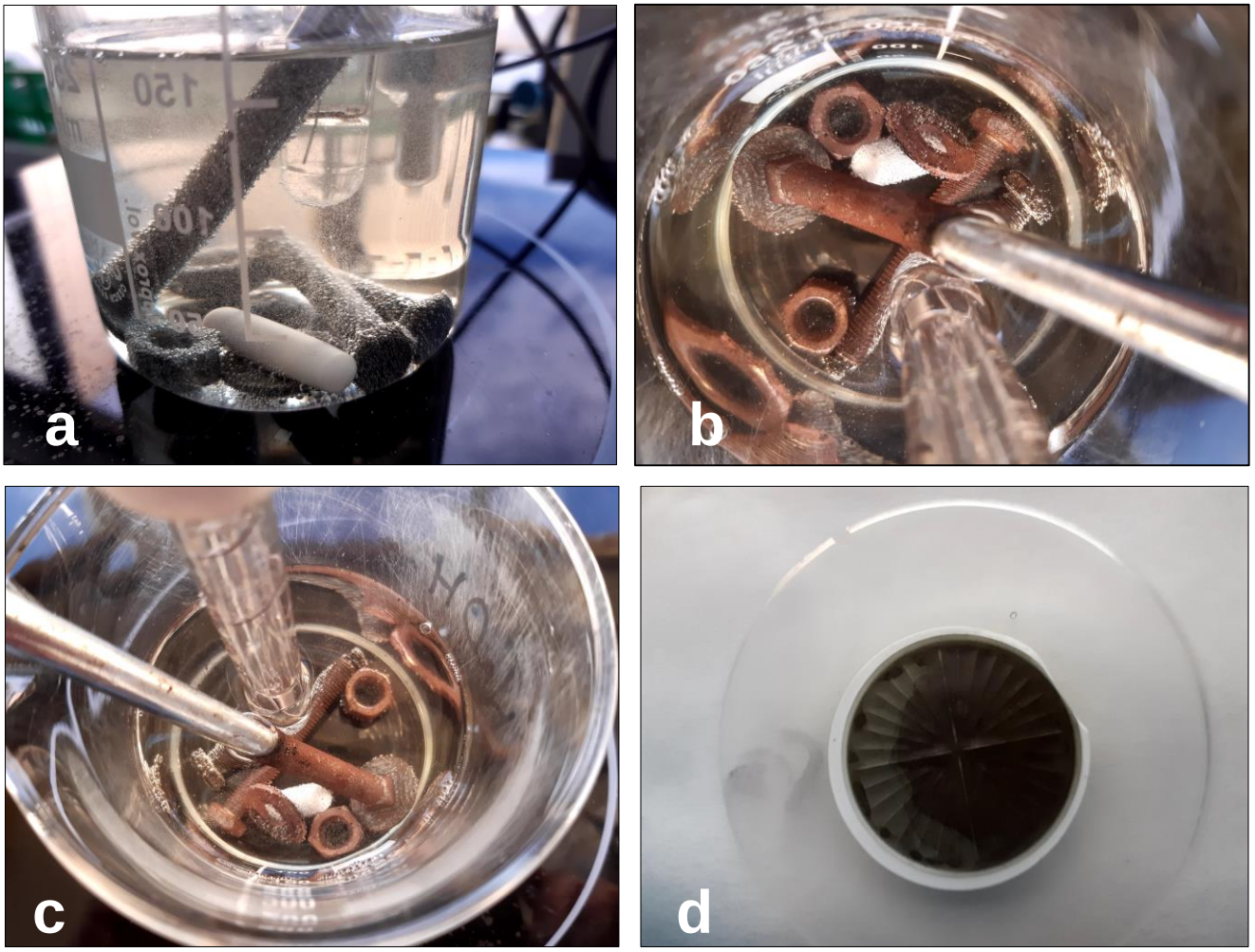


Figure S4. (a) Cementation experiment with AMD sample using iron hardware and conditions of pH=1.5 and T=25 ºC. Note the intense bubbling denoting hydrogen formation due to metallic iron edging by sulfuric acid; **(b-c)** Formation of metallic copper (Cu[0]) by direct Cu^{2+} reduction on the iron metal surfaces; **(d)** Aspect of one of the filters coated with Cu[0] formed in the cementation experiments.

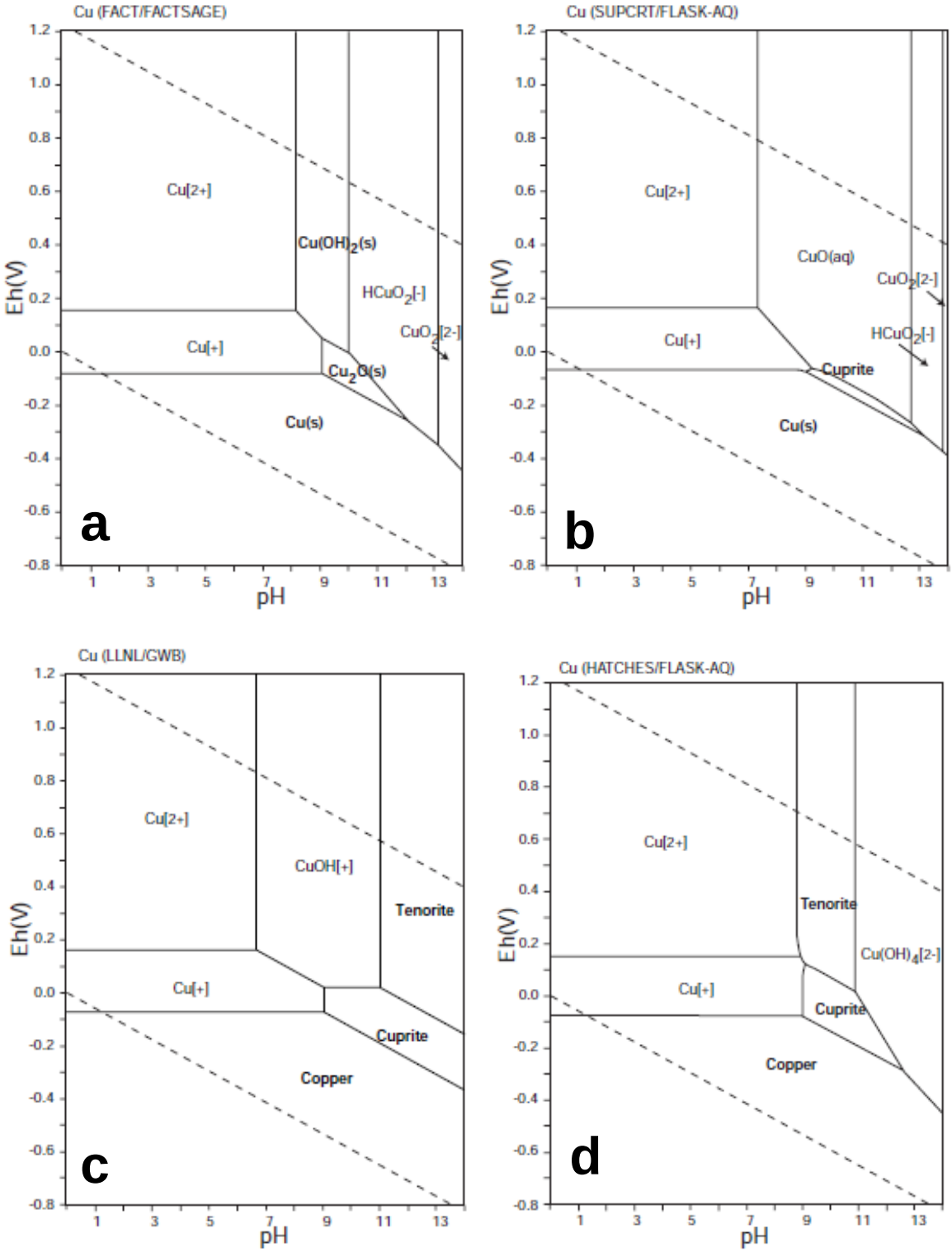


Figure S5. Compilation of Eh-pH diagrams for Cu species in the Cu-O-H system using different thermodynamic databases. Each database used for every Eh/pH diagram is indicated in the upper left corner. The conditions were always set at $\sum Cu=10^{-10}$ M, T=25 ºC, $p=10^5$ Pa (Reproduced from Takeno [32] with kind permission from the Geological Survey of Japan).