Exercise: calculate the overpotential in the Fe-porphyrin system

Recall experimental conditions:

In DMF; $[Et_3NH]Cl$ as acid; Working potential at -1.6 V vs. SCE
As Fc/Fc^+ = 0.47 vs. SCE in DMF
E(working) = -1.6 vs. SCE = -2.07 V vs. Fc/Fc^+

How about the thermodynamic potential of HER using $[Et_3NH]Cl$ in DMF?
Answer:
pk_a ($[Et_3NH]^+$) in DMF = 9.2
E^o_{H+} = -0.77 vs. Fc/Fc^+
E ($[Et_3NH]^+$) = -1.31 vs. Fc/Fc^+

The overpotential of the Fe-porphyrin system is therefore 0.76 V
This is a rather big overpotential;
it was dictated by the potential to reduce Fe(I) to Fe(0).