

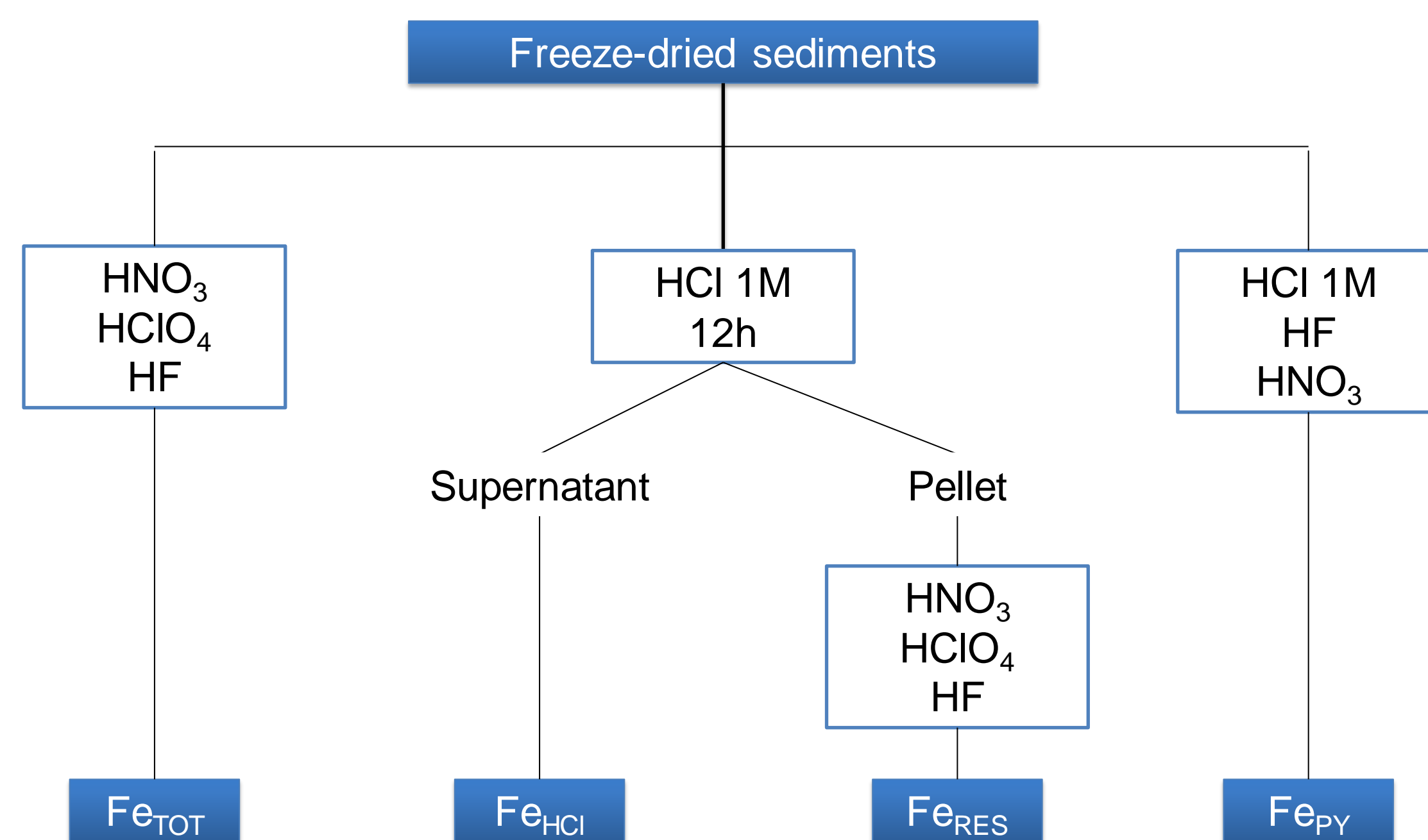
# IRON ISOTOPE FRACTIONATION IN ARCTIC OCEAN SEDIMENTS

## Introduction

To better document sources and sinks of Fe across the well-oxygenated Canada Basin in the Arctic Ocean, profiles of the concentrations and isotopic compositions of total Fe ( $Fe_{TOT}$ ), 1M HCl extractable Fe ( $Fe_{HCl}$ ), and residual Fe ( $Fe_{RES}$ ) remaining after the HCl extraction were determined in sediment cores collected at 51, 619 and 3130 m depth, respectively in the shelf, slope and abyssal portion of this basin. Concentrations of Fe associated to pyrite ( $Fe_{PY}$ ) were also determined in each of the cores through an operationally defined extraction protocol.

## Methodology

This sequential extraction scheme has been followed:



Digested sediments has been analysed for element concentration (ICP-AES) and Fe isotopic fractionation (MC-ICP-MS in high-resolution).

## Sampling sites

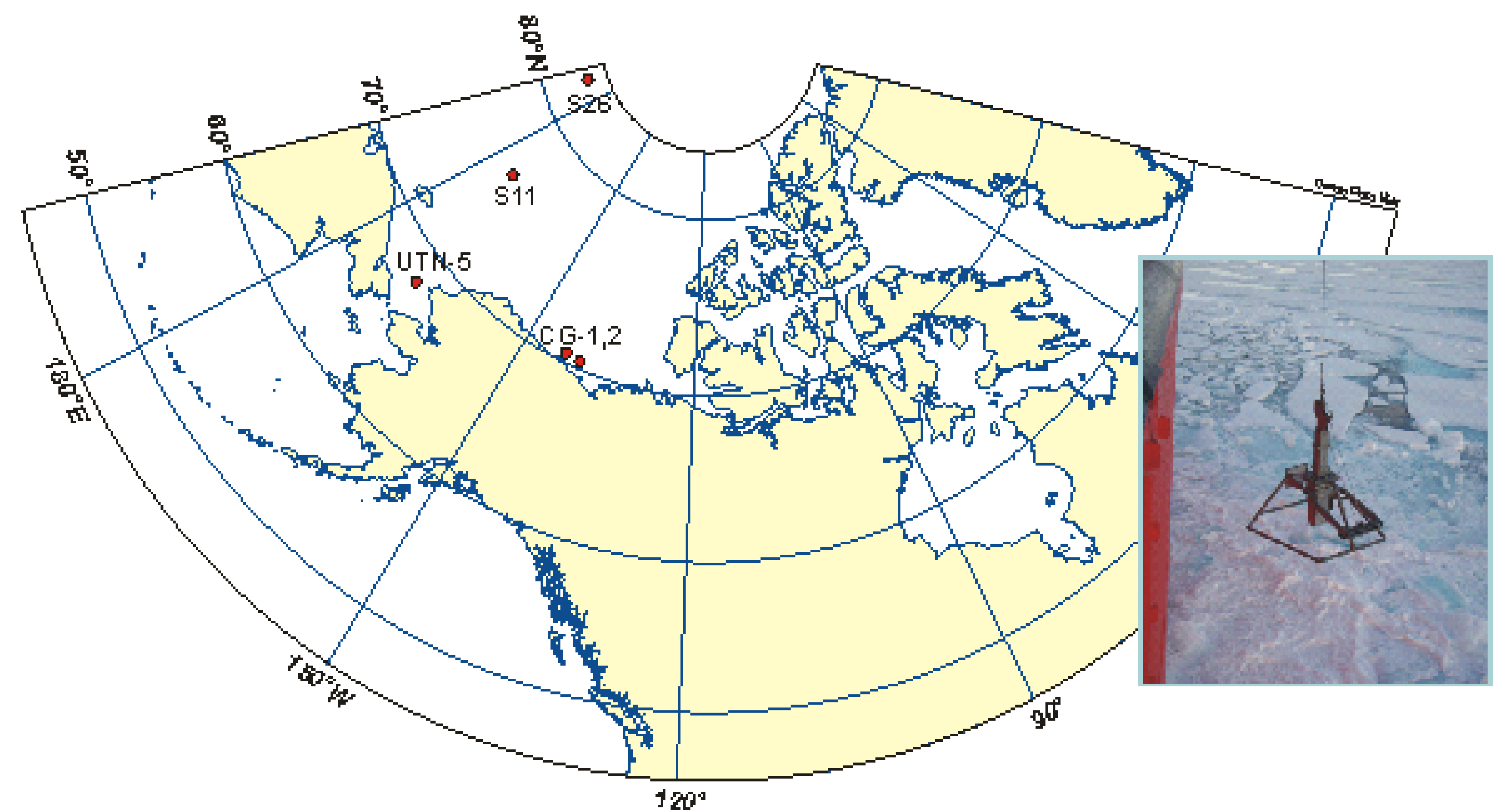


Figure 1. Sediment sampling sites with a box-corer in the Arctic Ocean

Table 1. Sediment sampling locations and water depth

Station	Latitude	Longitude	Depth (m)
UTN5	67°40.2 (N)	168°57.5 (O)	51
CG2	70°42.0 (N)	142°49.9 (O)	619
S26	84°03.8 (N)	175°05.3 (E)	3130

## Results

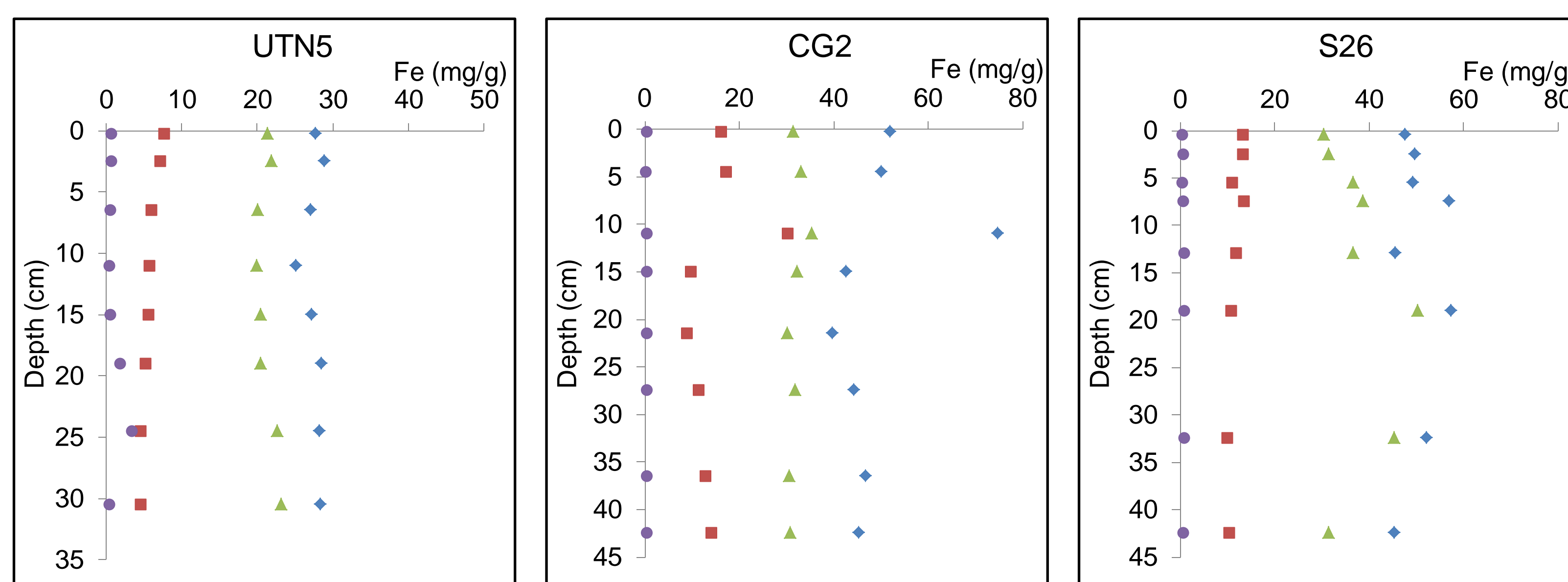


Figure 2. Vertical profiles of  $Fe_{TOT}$  (blue),  $Fe_{HCl}$  (red),  $Fe_{RES}$  (green) and  $Fe_{PY}$  (purple) in the sediments core

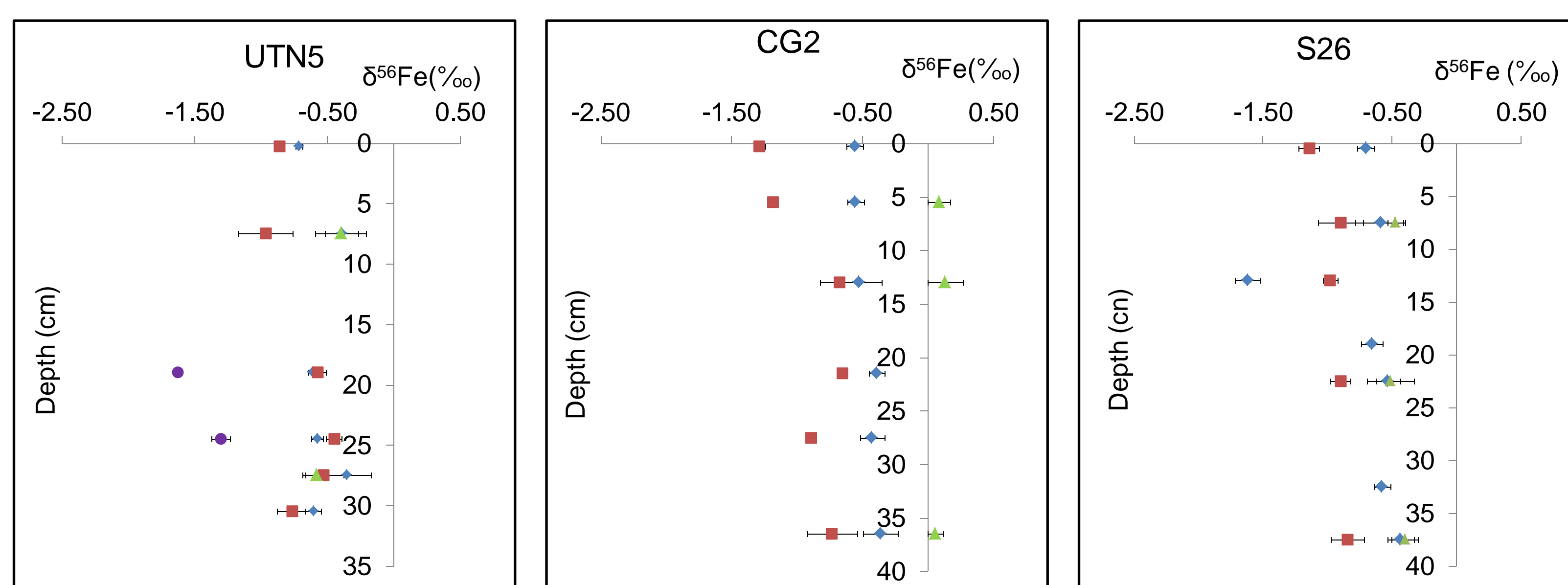


Figure 3. Vertical profiles of  $\delta^{56}Fe_{TOT}$  (blue),  $\delta^{56}Fe_{HCl}$  (red),  $\delta^{56}Fe_{RES}$  (green) and  $\delta^{56}Fe_{PY}$  (purple) in the sediments core

## Conclusion

The isotopic composition of  $Fe_{TOT}$  is slightly lighter in shelf sediments than in slope and deep basin sediments. In the shelf core, where the degree of pyritization (i.e.,  $DOP = Fe_{PY} / (Fe_{HCl} + Fe_{PY})$ ) progressively increases below the sediment-water interface reaching up to 42% at 25 cm depth, there is no pronounced difference between the isotopic composition of  $Fe_{TOT}$  and those of  $Fe_{HCl}$  and  $Fe_{RES}$  in samples exhibiting significant pyrite enrichment. In contrast, the  $Fe_{HCl}$  pools in the slope and deep basin cores are characterized by a light isotope composition relative to that of  $Fe_{TOT}$ , undetectable or negligible concentrations of  $Fe_{PY}$ , and much higher concentrations and inventories of  $Fe_{HCl}$  than in shelf sediments.

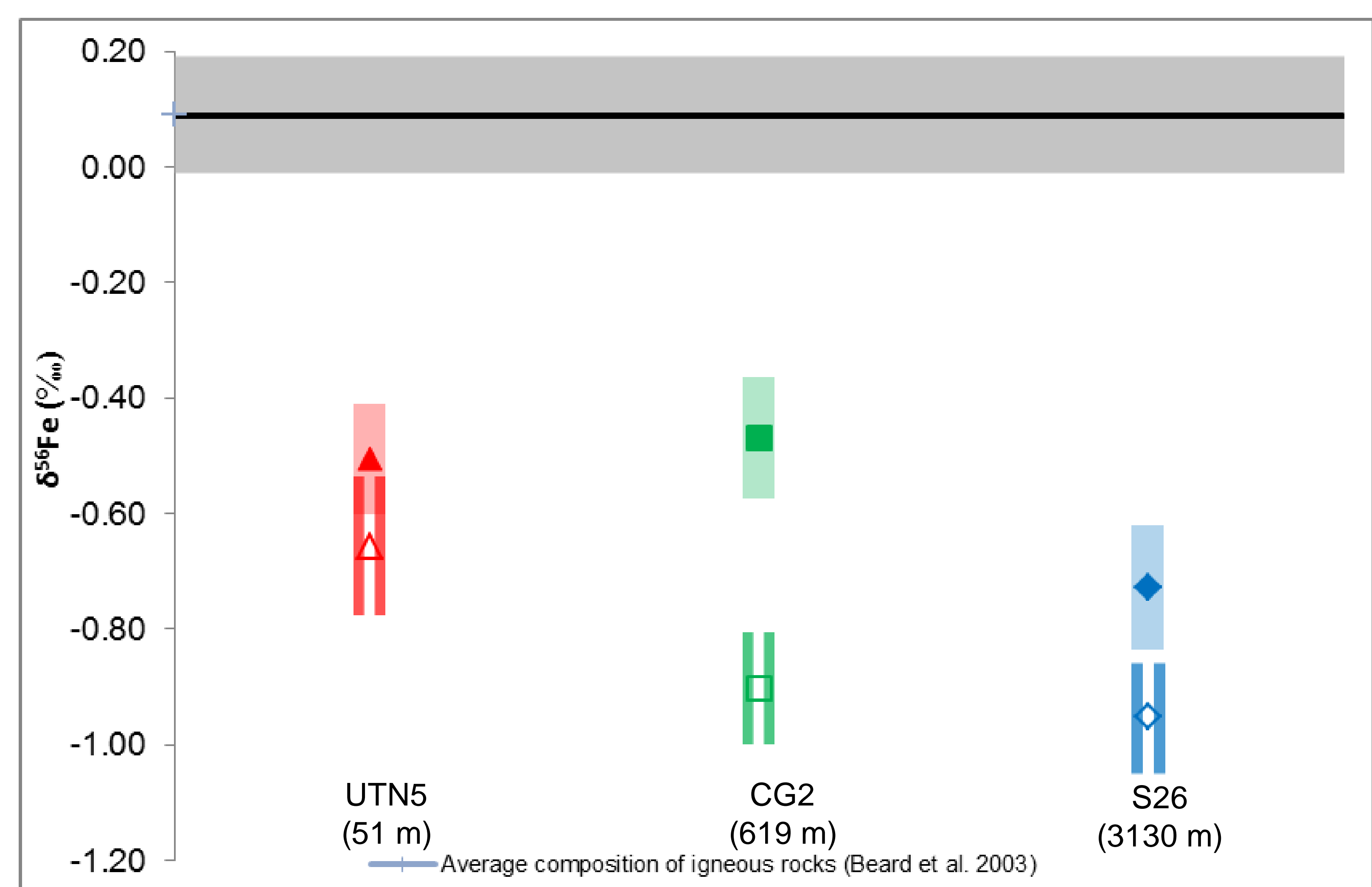


Figure 4. Mean iron isotopic fractionation of the sediment cores. Fill dots represent the  $Fe_{TOT}$  fractions and empty dots,  $Fe_{HCl}$  fractions

## Acknowledgments

We thank the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Fonds Québécois de Recherche Nature et technologies (FQRNT) for their financial support. P. Girard, B. Patry and A. Bensadoun for their technical support.

## References

- Beard BL et al. 2003 Application of Fe isotopes to tracing the geochemical and biological cycling of Fe. *Chemical Geology* 195(1-4):87-117
- Scholz F et al. (2014) On the isotope composition of reactive iron in marine sediments: Redox shuttle versus early diagenesis. *Chemical Geology* 389:48-59.
- Severmann S et al. (2010) The continental shelf benthic iron flux and its isotope composition. *Geochimica et Cosmochimica Acta* 74(14):3984-4004