How minimum are the minimum ages of deglaciation deduced from surface exposure dating? Assessment based on data from the Pyrenees (Iberian Peninsula)

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Surface exposure dating (SED) based on single cosmogenic radio nuclides (CRN) on glacial geomorphic features yield, if carefully selected, minimum ages for the last deglaciation event. The SED method is extremely valuable to constrain the age of otherways undateable landforms and the chronology of the deglaciation. However, due to the general lack of information on erosion rates, it is difficult to establish how close these minimum surface exposure ages are from the time of deglaciation.

Published ^{14}C and OSL data from deposits attributed to the last glaciation in the Pyrenees range up to 30 kyr cal BP and 85 OSL kyr respectively (see [1] for a review). In contrast, no moraines or erosion surfaces significantly older than 20 ^{10}Be kyr have been dated so far. Possible reasons for this apparent upper limit on ^{10}Be ages are that 1) only relatively young features have been targeted for SED dating (hypotesis favoured by [1] to help reconcile the contrasting ages obtained from different methods in different valleys) or 2) the relatively young ^{10}Be ages are associated with widespread erosion of till covering the surfaces sampled (boulders from moraine-tops and glacial erosion surfaces).

To try and establish an upper boundary on erosion rates and to assess the accuracy in terms of deglaciation ages of the ^{10}Be data published so far, we sampled blocky moraines attributed to the Last Pleniglacial, which we expect to be less affected by erosion than matrix-rich moraines.

[1] Pallàs *et al.* (2006) *Quaternary Science Reviews* **25**, 2937-2963.

Ni, Co, Fe-systematics of planetary basalts

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We have in our collections basaltic rocks from four planets: Earth, Mars, Moon and Vesta. The major element compositions of MORB, Shergottites, Apollo 12 and 15 mare basalts and eucrites are not very different, except for Al depletion in Shergottites and low FeO in MORB. Minor and trace elements may show significantly larger variations, as seen for example by Ni and Co in Table 1. All four basalts come from planets with FeNi-cores. Assuming that Ni and Co fractionation during basalt formation from silicate mantles is similar in the four planets, allows to estimate Ni and Co in the corresponding silicate mantles. The data of Table 1 show a clear correlation of Ni with planet size (for data see [1]). Cobalt shows a similar, but less pronounced trend.

	Earth MORB	***Mars Shergotty***	***Moon low-Ti***	***Vesta Eucrite***
Radius (km)	6378	3397	1745	258
FeO (%)	10,4	19,3	19,4	17,9
Ni (ppm)	150	80	50	4
Co (ppm)	50	40	45	5

Table 1.

The data may be interpreted to indicate that increasing Ni contents are predominantly the result of metal separation at increasingly higher pressures and temperatures, reflecting the strong increase of Ni metal/silicate partition coefficients with pressure and temperature [2]. In detail conditions of core formation may also depend on other variables. ´But it is clear that only eucrites show the very low Ni and Co contents expected from metal/silicate equilibration at low pressures [3]. For the Earth the high Ni in MORB is exacerbated by the low FeO and it is unclear if this can be achieved solely by metal separation even at very high depths in the interior of the Earth [2].

[1] Kegler Ph. *et al.* (2006) *LPSC* **XXXVII** 1785. [2] Kegler Ph. *et al.* (2008, in press) *EPSL.* [3] Holzheid A. & Palme H. (2007) *MAPS* **42**, 1817-1829.