GSA DATA REPOSITORY 2010248 **Pallàs et al.**

Data Repository Item DR1: ^{10}Be surface exposure sampling, sample preparation and age calculation

After detailed geomorphological mapping, we selected 52 ^{10}Be samples (including 10 granitic glacial erosion surfaces, 1 hornfels glacial erosion surface, and 41 granitic moraine boulders) to cover the widest possible range of glacial phases. We took between 4 and 6 samples per moraine, and 1 to 3 samples per erosion surface, depending on availability. To minimise the risks of shielding by till, soil cover, or snow, we chose the highest and most prominent roches moutonées located at some distance from till-covered areas. Similarly, in an attempt to avoid underexposure we selected only boulders well anchored in till or in contact with other boulders. Boulders found on gentle slopes and protruding more than 1 m over surrounding till were favoured.

Sample treatment was performed in the Cosmogenic Isotope Laboratory at the Universitat de Barcelona. Samples were crushed and sieved to extract the 0.25-1 mm granulometric fraction. Minerals other than quartz were dissolved by HCl and H_2SiF_6, and remaining quartz grains were cleaned using sequential HF dissolutions to remove any potential atmospheric ^{10}Be (Brown et al., 1991; Kohl and Nishiizumi, 1992; Cerling and Craig, 1994). Between 15 and 30 g per sample of clean quartz cores were then completely dissolved in HF and spiked with 300 mg of ^{9}Be carrier (Bourlès, 1988; Brown et al., 1992). Beryllium was separated by successive solvent extractions and alkaline precipitations (Bourlès, 1988; Brown et al., 1992).

Measurements of ^{10}Be concentrations for samples from the Querol catchment and sample LAF02 were taken at the Tandetron AMS facility of Gif-sur-Yvette, France (Raisbeck et al., 1994). Measurements of ^{10}Be concentrations for samples from the Malniu catchment with the exception of sample LAF02 were performed at the ASTER

AMS facility of Aix-en-Provence, France. The measured $^{10}Be/^{9}Be$ ratios were corrected for procedural blanks and calibrated against the National Institute of Standards and Technology standard reference material 4325 by using an assigned value of 2.79±0.03xe-11 and using a ^{10}Be half-life of 1.36± 0.07xe6 years (Nishiizumi et al., 2007). Analytical uncertainties (reported as 1 sigma) include uncertainties associated with AMS counting statistics, AMS external error and chemical blank measurement. ^{10}Be concentrations in quartz were calculated following Balco (2006, 2009) and Balco et al. (2008), and using the CRONUS online calculator v. 2.2. All ages are reported with no correction for erosion or snow cover to ensure that they are treated as minimum ages of exposure.

References

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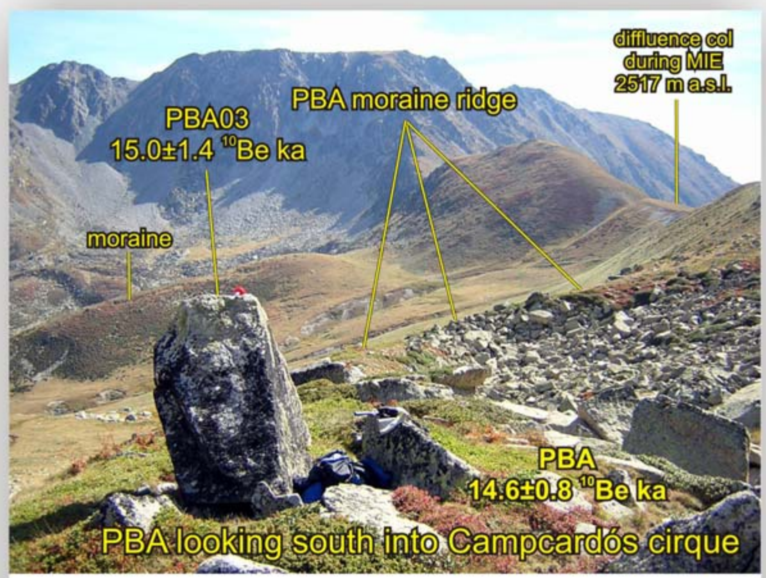
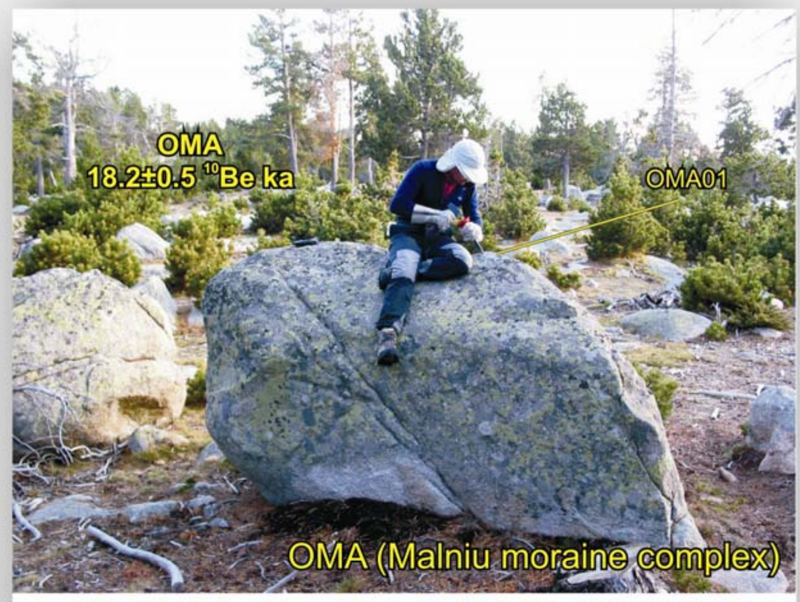
Data Repository Item DR2: Images from ^{10}Be sampling sites

Lateglacial morainic suite. Note the very large boulders but gentle slope on Puigmorens diffluence col, and the succession of morainic ridges (LOR moraines) in the background

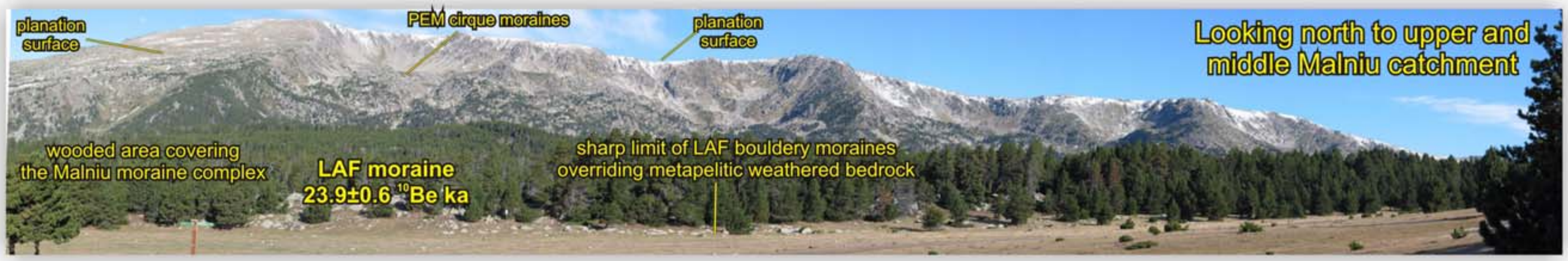


Crested bouldery moraine next to cirque headwall, formed by a niche glacier. The slope in the background facing north deglaciated later than PBA.

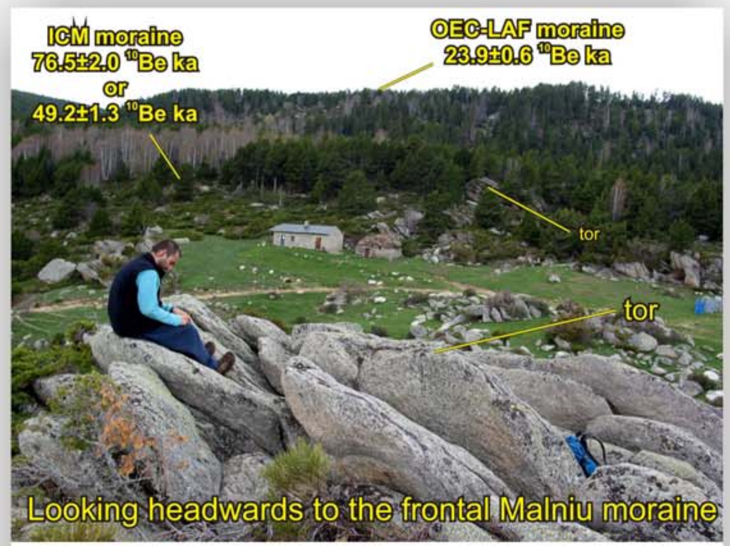
Large broken boulder on gently sloping moraine.
In such flat areas boulder fragmentation is thought to be more relevant to TCN dating than gradual till erosion.



Bouldery moraine on the surface of a gentle topographic divide. Ideal setting in which the risk of postglacial boulder exhumation from a finer matrix is minimal. Confidence on TCN dating accuracy is improved.



The main frontal ridge of OEC moraine is seen through the trees in the background. It is a narrow bouldery moraine, affected by kettle structures suggesting some postdepositional deformation. Its minimum age is imposed by the exposure age measured at LAF (23.9±0.6 ^{10}Be ka).



Highly weathered tor with no signs of glacial erosion (foreground) located between the outer Malniu moraine complex (ICM and OEC) and the right lateral (YRA) moraine of the Querol valley (in the opposite direction)

The LGM main right lateral moraine of the Querol glacial system is a crested bouldery moraine abutting the Cerdanya intramontane basin. It yielded two groups of boulders with contrasting exposure ages YRA(a) and YRA (b). The rounded hill in the mid distance on the right (1305 m a.s.l.) is covered by the outermost till of the Querol Valley and crop fields.

Tables DR1, DR2, and DR3:

Table 1: Field and laboratory data used for calculation of ^{10}Be surface exposure ages of glacial features from Querol and Malniu-Mal catchments

Sample name	Sample type	Rock type	Latitude[1] (DD)	Longitude[1] (DD)	Elevation[2] (m)	Elv/pressure flag	Thickness (cm)	Density (g cm-2)	Shielding correction [3]	Cover correction	Erosion rate (cm yr-1)	[Be-10][4] atoms g-1	+/- atoms g-1	Name of Be-10 standardization
CAS01	Erosion surface	granodiorite	42.54449	1.82204	1684	std	3	2.69	0.98175	none	0	179318.9	19048.1	NIST_Certified
CAS02	Erosion surface	granodiorite	42.54449	1.82295	1679	std	4	2.69	0.98175	none	0	203358.1	26161.6	NIST_Certified
CAS03	Erosion surface	granodiorite	42.54424	1.82363	1673	std	4.5	2.69	0.98175	none	0	248063.4	27697.2	NIST_Certified
CPM01	Moraine boulder	granodiorite	42.55899	1.79165	2042	std	1.8	2.69	0.99895	none	0	316159.3	43725.5	NIST_Certified
CPM02	Moraine boulder	granodiorite	42.55913	1.79168	2041	std	1.3	2.69	0.99895	none	0	292338.7	47122.	NIST_Certified
CPM03	Moraine boulder	granodiorite	42.55944	1.7936	2035	std	1.5	2.69	0.99895	none	0	316330.6	45771.1	NIST_Certified
CPM04	Moraine boulder	granodiorite	42.55951	1.79406	2033	std	2.1	2.69	0.99895	none	0	235501.1	24368.	NIST_Certified
FUL01	Erosion surface	granodiorite	42.51385	1.82532	1513	std	1.5	2.69	0.94572	none	0	206027.7	33262.6	NIST_Certified
FUL03	Erosion surface	granodiorite	42.51261	1.82474	1465	std	4.3	2.69	0.94616	none	0	249199.6	42250.	NIST_Certified
ICM01	Moraine boulder	granodiorite	42.47213	1.84328	1840	std	1.3	2.69	0.99673	none	0	914428.8	23773.3	NIST_27900
ICM02	Moraine boulder	granodiorite	42.47202	1.84304	1845	std	2.5	2.69	0.99673	none	0	780913.2	20482.5	NIST_27900
ICM03	Moraine boulder	granodiorite	42.47166	1.84255	1855	std	1.5	2.69	0.99673	none	0	762888.2	19928.4	NIST_27900
ICM04	Moraine boulder	granodiorite	42.47135	1.84224	1860	std	1.5	2.69	0.99673	none	0	1428796.5	36047.4	NIST_27900
IMA01	Moraine boulder	granodiorite	42.47365	1.795	2284	std	1.8	2.69	0.99684	none	0	387804.1	11057.2	NIST_27900
IMA02	Moraine boulder	granodiorite	42.47354	1.79471	2288	std	1.2	2.69	0.99684	none	0	356550.1	9993.2	NIST_27900
IMA03	Moraine boulder	granodiorite	42.47369	1.79486	2296	std	1.4	2.69	0.99684	none	0	395692.8	11095.	NIST_27900
IMA04	Moraine boulder	granodiorite	42.47559	1.79654	2291	std	2.1	2.69	0.99479	none	0	389403.9	11065.8	NIST_27900
IMA05	Moraine boulder	granodiorite	42.47572	1.79654	2301	std	2.2	2.69	0.99479	none	0	397123.	10688.3	NIST_27900
LAF01	Moraine boulder	granodiorite	42.46559	1.81506	2163	std	3.6	2.69	0.99923	none	0	461422.5	32058.6	NIST_Certified
LAF02	Moraine boulder	granodiorite	42.46492	1.81214	2188	std	2	2.69	0.99923	none	0	717731.9	132914.2	NIST_Certified
LAF03	Moraine boulder	granodiorite	42.46593	1.81637	2160	std	2.6	2.69	0.99923	none	0	410246.6	11302.8	NIST_27900
LAF04	Moraine boulder	granodiorite	42.46269	1.80369	2211	std	1.5	2.69	0.99923	none	0	576105.1	15508.1	NIST_27900
LAT01	Erosion surface	hornfels	42.46861	1.8821	1280	std	1.5	2.69	0.98082	none	0	225076.2	31529.5	NIST_Certified
LOR01	Moraine boulder	granodiorite	42.53645	1.77416	2347	std	1.8	2.69	0.96541	none	0	293919.5	31939.8	NIST_Certified
LOR03	Moraine boulder	granodiorite	42.54114	1.77768	2280	std	1	2.69	0.99021	none	0	302200.1	35601.6	NIST_Certified
LOR04	Moraine boulder	granodiorite	42.54138	1.77788	2276	std	2.6	2.69	0.99021	none	0	269259.8	21484.	NIST_Certified
LOR05	Moraine boulder	granodiorite	42.54146	1.77796	2276	std	1.3	2.69	0.99021	none	0	309971.2	42781.7	NIST_Certified
OEC01	Moraine boulder	granodiorite	42.4704	1.83151	1992	std	1	2.69	0.99804	none	0	445374.2	12676.6	NIST_27900
OEC02	Moraine boulder	granodiorite	42.47105	1.83744	1945	std	2	2.69	0.99929	none	0	395964.6	11441.	NIST_27900
OEC03	Moraine boulder	granodiorite	42.47138	1.83864	1930	std	2	2.69	0.99804	none	0	323294.2	10543.	NIST_27900
OEC04	Moraine boulder	granodiorite	42.47377	1.84006	1925	std	2.5	2.69	0.99941	none	0	316913.9	9083.9	NIST_27900
OEC05	Moraine boulder	granodiorite	42.47476	1.84075	1925	std	1	2.69	0.99804	none	0	382823.3	11469.6	NIST_27900
OEC06	Moraine boulder	granodiorite	42.47593	1.83999	1920	std	1.3	2.69	0.99804	none	0	321389.2	10012.3	NIST_27900
OMA01	Moraine boulder	granodiorite	42.46721	1.79425	2265	std	1.6	2.69	0.99883	none	0	440089.1	12088.4	NIST_27900
OMA02	Moraine boulder	granodiorite	42.46714	1.79409	2270	std	2.1	2.69	0.99883	none	0	456903.8	12444.6	NIST_27900
OMA03	Moraine boulder	granodiorite	42.46715	1.79412	2271	std	1.8	2.69	0.99883	none	0	427369.4	11684.	NIST_27900
OMA04	Moraine boulder	granodiorite	42.46701	1.79412	2264	std	2.3	2.69	0.99883	none	0	419965.	11754.9	NIST_27900
PBA01	Moraine boulder	granodiorite	42.50701	1.7271	2521	std	2.8	2.69	0.96609	none	0	310457.1	55789.9	NIST_Certified
PBA02	Moraine boulder	granodiorite	42.5078	1.72715	2526	std	1.7	2.69	0.96943	none	0	402498.6	26952.5	NIST_Certified
PBA03	Moraine boulder	granodiorite	42.50792	1.72713	2529	std	2	2.69	0.96943	none	0	416185.6	40048.1	NIST_Certified
PBA04	Moraine boulder	granodiorite	42.50866	1.72704	2536	std	3.8	2.69	0.97283	none	0	360051.9	33309.3	NIST_Certified
PEI01	Erosion surface	granodiorite	42.50757	1.77195	2092	std	3.1	2.69	0.95135	none	0	237410.9	23940.6	NIST_Certified
PEI02	Erosion surface	granodiorite	42.5075	1.77184	2090	std	2.5	2.69	0.95135	none	0	198664.7	18727.9	NIST_Certified
QRS01	Erosion surface	granodiorite	42.48062	1.86411	1322	std	1.5	2.69	0.9741	none	0	239247.3	48532.9	NIST_Certified
QRS02	Erosion surface	granodiorite	42.4809	1.86395	1348	std	4	2.69	0.9741	none	0	201386.2	23740.2	NIST_Certified
QRS03	Erosion surface	granodiorite	42.48097	1.86375	1351	std	2.8	2.69	0.9741	none	0	199175.2	31719.7	NIST_Certified
YRA01	Moraine boulder	granodiorite	42.46167	1.87707	1486	std	2.5	2.69	0.998	none	0	228339.2	30157.	NIST_Certified
YRA03	Moraine boulder	granodiorite	42.46756	1.86446	1541	std	3	2.69	0.99566	none	0	218048.	27565.5	NIST_Certified
YRA06	Moraine boulder	granodiorite	42.45601	1.88854	1355	std	2.4	2.69	0.99883	none	0	191987.7	30874.6	NIST_Certified
YRA19	Moraine boulder	granodiorite	42.45667	1.889	1330	std	0.0	2.69	0.99462	none	0	280154.	33275.	NIST_Certified
YRA20	Moraine boulder	granodiorite	42.45639	1.8895	1310	std	0.0	2.69	0.99462	none	0	268418.4	40900.2	NIST_Certified
YRA21	Moraine boulder	granodiorite	42.45583	1.89	1300	std	0.0	2.69	0.99462	none	0	259262.8	33400.3	NIST_Certified

[1] With reference to WGS84 datum

[2] uncertainty ± 5 m

[3] assuming exponent x=2.3 in the cosmic ray flux equation: cos^x (zenith angle)

[4] Blank values used (ratio 10Be/9Be in at/at):

8,31820E-15	CAS01, CAS02, CAS03, CPM01, CPM02, CPM03, CPM04, FUL01, FUL03, LAF01, LAF02, LAT01, LOR01, LOR03, LOR04, LOR05, PBA01, PBA02, PBA03, PBA04, PEI01
4,44722E-15	PEI02
5,57092E-15	QRS01
4,04800E-15	QRS02, QRS03, YRA01, YRA03, YRA05, YRA06, YRA19, OEC02, OEC04, LAF04, OMA02, IMA01
4,19538E-15	YRA20,
1,16800E-14	YRA21, ICM03, ICM04, OEC01, OEC03, OEC05, OEC06, OMA01, OMA03, OMA04, IMA02
1,14344E-14	ICM01
4,34175E-15	LAF03
4,20000E-15	IMA03, IMA04, IMA05

Minimum ages for each landform represented in Fig. 1 and DR Item 4 were obtained according to criteria explained in the Methods and Results section:

CAS scoured bedrock minimum age deduced from CAS03 exposure age
CPM moraine minimum age deduced from weighted mean of CPM01, CPM02, CPM03 exposure ages
FUL scoured bedrock minimum age deduced from FUL03 exposure age
ICM moraine minimum age deduced from ICM04 or ICM01 exposure ages
IMA moraine minimum age deduced from weighted mean of IMA01, IMA03, IMA04, IMA05 exposure ages
LAF moraine minimum age deduced from LAF02 exposure age
LAT scoured bedrock minimum age deduced from LAT01 exposure age
LOR moraine minimum age deduced from weighted mean of LOR01, LOR03, LOR04, LOR05 exposure ages
OEC moraine minimum age deduced from OEC01 exposure age
OMA moraine minimum age deduced from OMA02 exposure age
PBA moraine minimum age deduced from weighted mean of PBA02, PBA03 exposure ages
PEI scoured bedrock minimum age deduced from PEI01 exposure age
QRS scoured bedrock minimum deduced from QRS01 exposure age
YRAa moraine minimum age deduced from weighted mean of YRA19, YRA20, YRA21 exposure ages
YRAb moraine minimum age deduced from weighted mean of YRA01, YRA03, YRA06 exposure ages

Table 2: ^{10}Be exposure age results for glacial features from Querol and Malniu-Mal catchments for constant production rate model. Output from CRONUS-Earth online calculator (Balco et al., 2008)

Version information

Component	Version
Wrapper script:	2.2
Main calculator:	2.1
Constants:	2.2
Muons:	1.1

Production rate calibration information: Using default calibration

	Results not dependent on spallogenic production rate model:				Exposure ages constant production rate model: Scaling scheme for spallation: Lal(1991) / Stone(2000)		
Sample name	Thickness scaling factor	Shielding factor	Production rate (muons)	Internal uncertainty (yr)	Exposure age (yr)	External uncertainty (yr)	Production rate (spallation)
CAS01	0.9752	0.9818	0.309	1222	11468	1578	16.04
CAS02	0.9671	0.9818	0.308	1699	13166	2051	15.85
CAS03	0.9631	0.9818	0.307	1817	16209	2302	15.71
CPM01	0.9850	0.9990	0.347	2121	15276	2505	21.31
CPM02	0.9892	0.9990	0.348	2276	14072	2586	21.39
CPM03	0.9875	0.9990	0.347	2225	15320	2596	21.26
CPM04	0.9826	0.9990	0.346	1190	11467	1554	21.13
FUL01	0.9875	0.9457	0.294	2484	15327	2821	13.77
FUL03	0.9647	0.9462	0.288	3352	19672	3766	12.98
ICM01	0.9892	0.9967	0.327	1297	49247	4522	18.48
ICM02	0.9793	0.9967	0.326	1120	42251	3875	18.36
ICM03	0.9875	0.9967	0.328	1072	40629	3724	18.64
ICM04	0.9875	0.9967	0.329	1969	76517	7058	18.71
IMA01	0.9850	0.9968	0.374	438	15296	1404	25.08
IMA02	0.9900	0.9968	0.376	392	13951	1278	25.27
IMA03	0.9883	0.9968	0.376	434	15432	1414	25.37
IMA04	0.9826	0.9948	0.375	438	15357	1409	25.08
IMA05	0.9817	0.9948	0.375	421	15570	1421	25.23
LAF01	0.9703	0.9992	0.358	1459	20883	2335	22.80
LAF02	0.9834	0.9992	0.363	5900	31602	6516	23.50
LAF03	0.9785	0.9992	0.359	489	17685	1619	22.94
LAF04	0.9875	0.9992	0.366	645	23810	2178	23.98
LAT01	0.9875	0.9808	0.273	2714	19279	3193	11.96
LOR01	0.9850	0.9654	0.381	1301	11935	1665	25.37
LOR03	0.9916	0.9902	0.375	1469	12433	1826	25.04
LOR04	0.9785	0.9902	0.372	900	11253	1331	24.64
LOR05	0.9892	0.9902	0.374	1775	12820	2098	24.91
OEC01	0.9916	0.9980	0.343	610	21317	1959	20.66
OEC02	0.9834	0.9993	0.337	573	19716	1814	19.85
OEC03	0.9834	0.9980	0.335	533	16274	1516	19.61
OEC04	0.9793	0.9994	0.334	462	16052	1474	19.49
OEC05	0.9916	0.9980	0.336	578	19192	1772	19.71
OEC06	0.9892	0.9980	0.335	507	16196	1501	19.59
OMA01	0.9867	0.9988	0.372	484	17530	1604	24.84
OMA02	0.9826	0.9988	0.372	499	18218	1666	24.82
OMA03	0.9850	0.9988	0.373	466	16981	1553	24.90
OMA04	0.9809	0.9988	0.371	473	16834	1543	24.68
PBA01	0.9768	0.9661	0.400	2043	11337	2269	28.23
PBA02	0.9858	0.9694	0.403	973	14480	1594	28.68
PBA03	0.9834	0.9694	0.403	1447	14982	1950	28.67
PBA04	0.9687	0.9728	0.400	1211	13045	1661	28.47
PEI01	0.9744	0.9514	0.351	1189	11754	1569	20.77
PEI02	0.9793	0.9514	0.352	926	9796	1259	20.84
QRS01	0.9875	0.9741	0.277	4075	19984	4432	12.27
QRS02	0.9671	0.9741	0.277	1992	16823	2474	12.26
QRS03	0.9768	0.9741	0.278	2629	16436	2994	12.41
YRA01	0.9793	0.9980	0.291	2201	16595	2634	14.11
YRA03	0.9752	0.9957	0.296	1943	15306	2357	14.61
YRA06	0.9801	0.9988	0.279	2480	15363	2819	12.80
YRA19	10.000	0.9946	0.278	2692	22531	3335	12.76
YRA20	10.000	0.9946	0.276	3358	21914	3865	12.56
YRA21	10.000	0.9946	0.276	2762	21325	3331	12.47

Table 3: ^{10}Be exposure age results for glacial features from Querol and Malniu-Mal catchments for time-varying production models. Output from CRONUS-Earth online calculator (Balco et al., 2008)

Whatever the scaling scheme used, ages fall within 1s interval from those of Lal(1991)/Stone(2000)

Output from CRONUS online calculator (Balco et al., 2008)

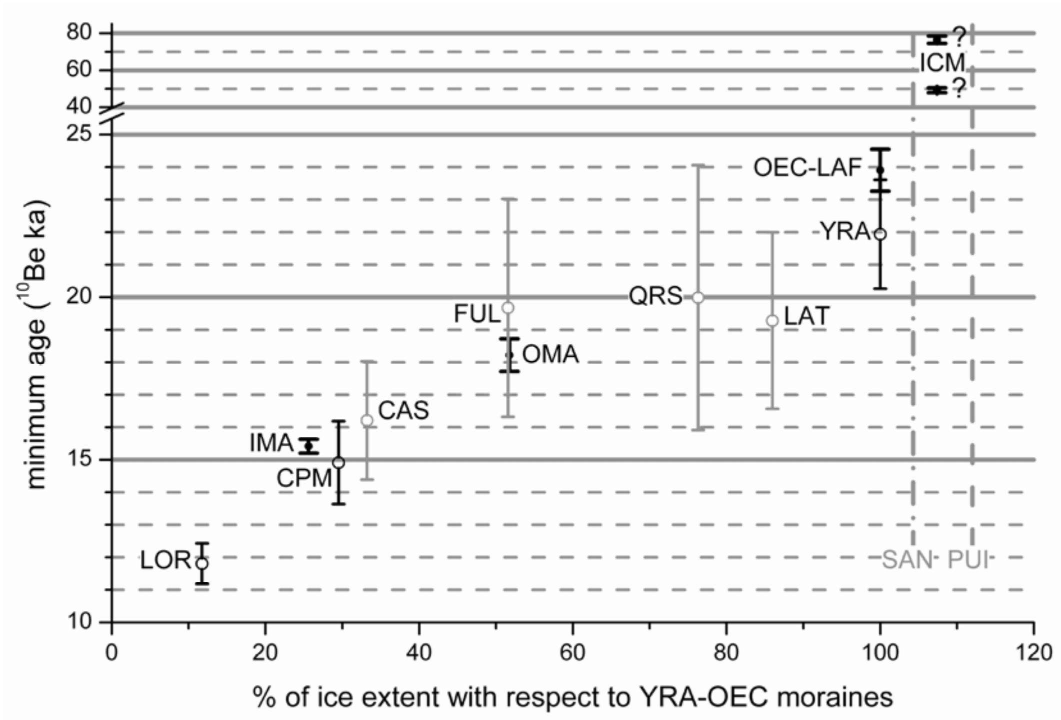
Version information

Component	Version
Wrapper script:	2.2
Main calculator:	2.1
Constants:	2.2
Muons:	1.1

Production rate calibration information: Using default calibration

	Exposure ages -- time-varying production models:							
	Scaling scheme for spallation:							
	Desilets and others -		Dunai-2001		Lifton and others-2005		Time-dependent	
Sample name	Exposure age (yr)	External uncertainty (yr)	Exposure age (yr)	External uncertainty (yr)	Exposure age (yr)	External uncertainty (yr)	Exposure age (yr)	External uncertainty (yr)
CAS01	11897	1894	12170	1933	11672	1696	11432	1555
CAS02	13619	2385	13869	2424	13373	2175	13136	2027
CAS03	16623	2711	16841	2740	16317	2440	16108	2263
CPM01	15422	2814	15664	2853	15113	2577	15178	2468
CPM02	14260	2858	14516	2905	13976	2650	14008	2557
CPM03	15471	2899	15712	2939	15161	2665	15221	2559
CPM04	11683	1838	11982	1881	11436	1639	11411	1527
FUL01	15879	3188	16097	3226	15607	2964	15270	2792
FUL03	20207	4195	20394	4227	19834	3909	19472	3705
ICM01	47315	5783	47463	5776	45599	4703	46593	4159
ICM02	40845	4986	40986	4982	39562	4076	40239	3589
ICM03	39357	4801	39496	4798	38170	3930	38782	3456
ICM04	73711	9057	73654	9011	71204	7377	72815	6526
IMA01	15239	1856	15493	1879	14916	1536	15180	1356
IMA02	13952	1697	14225	1723	13652	1404	13874	1237
IMA03	15356	1869	15609	1891	15030	1546	15309	1365
IMA04	15290	1862	15543	1885	14965	1541	15237	1361
IMA05	15482	1880	15733	1902	15152	1554	15441	1372
LAF01	20646	2841	20839	2858	20178	2446	20536	2255
LAF02	30507	6750	30636	6770	29678	6273	30493	6253
LAF03	17613	2142	17838	2161	17233	1771	17475	1556
LAF04	23314	2837	23482	2845	22762	2339	23283	2072
LAT01	19987	3678	20170	3705	19644	3382	19119	3141
LOR01	11939	1920	12245	1965	11665	1717	11867	1637
LOR03	12476	2086	12772	2131	12203	1880	12370	1797
LOR04	11312	1615	11625	1655	11054	1406	11184	1302
LOR05	12859	2342	13148	2390	12579	2140	12756	2070
OEC01	21257	2592	21442	2604	20792	2144	20974	1876
OEC02	19777	2413	19977	2427	19357	1998	19447	1741
OEC03	16478	2024	16707	2044	16152	1684	16145	1465
OEC04	16268	1982	16500	2002	15949	1644	15933	1424
OEC05	19292	2359	19497	2374	18888	1955	18946	1703
OEC06	16411	2010	16641	2030	16088	1670	16072	1450
OMA01	17362	2111	17591	2130	16979	1745	17317	1542
OMA02	18004	2189	18227	2207	17602	1808	17973	1599
OMA03	16839	2047	17073	2067	16472	1692	16792	1494
OMA04	16708	2033	16944	2054	16346	1682	16653	1485
PBA01	11228	2420	11552	2487	10956	2252	11257	2241
PBA02	14252	1940	14525	1970	13932	1666	14375	1553
PBA03	14722	2249	14988	2284	14390	1989	14862	1908
PBA04	12875	1936	13173	1975	12576	1706	12966	1628
PEI01	11936	1858	12233	1899	11681	1652	11697	1542
PEI02	9984	1511	10303	1555	9750	1333	9739	1235
QRS01	20650	4871	20830	4908	20286	4599	19794	4370
QRS02	17482	2928	17683	2955	17189	2653	16732	2435
QRS03	17096	3403	17299	3438	16812	3162	16359	2960
YRA01	17152	3050	17360	3081	16852	2789	16497	2596
YRA03	15841	2750	16061	2782	15568	2505	15247	2326
YRA06	16030	3210	16240	3247	15771	2987	15319	2792
YRA19	23143	3896	23312	3916	22717	3527	22239	3257
YRA20	22562	4372	22732	4398	22156	4044	21654	3792
YRA21	21997	3863	22168	3885	21604	3524	21092	3265

Figure DR1: Minimum moraine ages vs. reconstructed ice length



Minimum ages of moraines and glacially eroded bedrock outcrops in the Querol and Malniu catchments vs. reconstructed glacier lengths for time of deglaciation at sampling site. Open circles and black circles correspond to the Querol and the Malniu catchment, respectively. Samples from glacial erosion surfaces are in grey and those from moraine boulders in black. Glacier lengths were measured from the top of cirque walls to frontal moraines or to reconstructed ice margins shown in Fig. 1. They are plotted relative to those deduced for the YRA moraine constructional phase in the Querol catchment and to those for the OEC-LAF moraine in the Malniu catchment. Vertical lines mark the relative ice extent deduced from the SAN and PUI moraines in the Querol catchment.