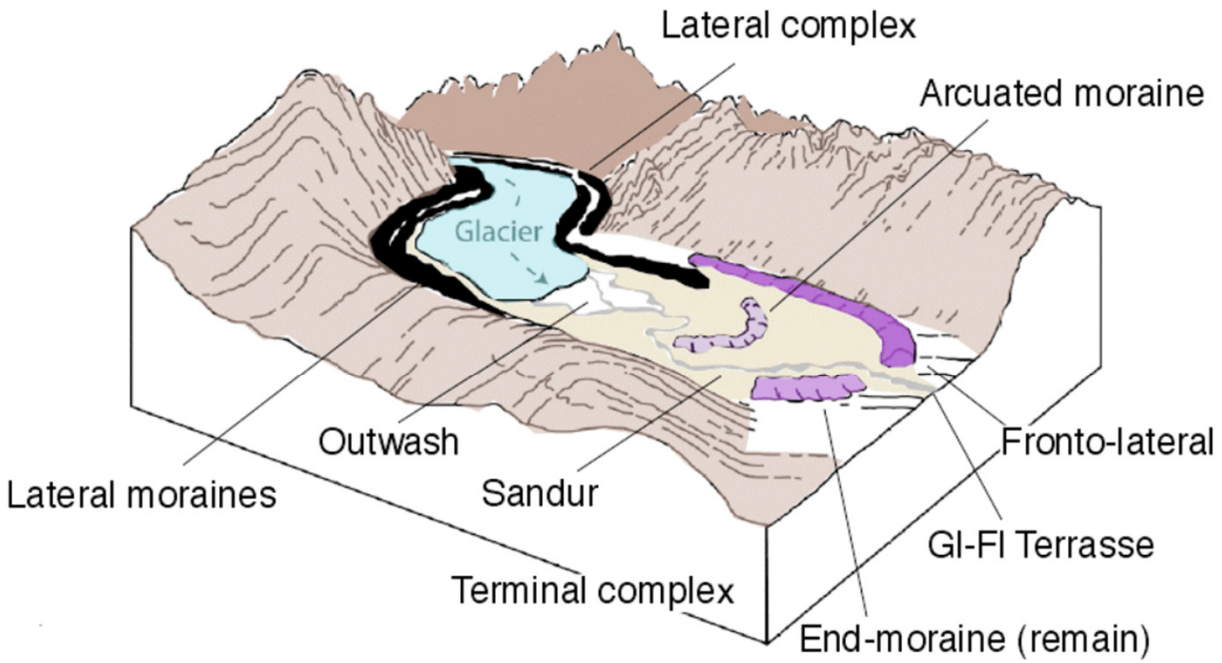
Typologies glaciaires dans la Péninsule Ibérique et leur projection vers les massifs voisins du continent européen et nord-africain

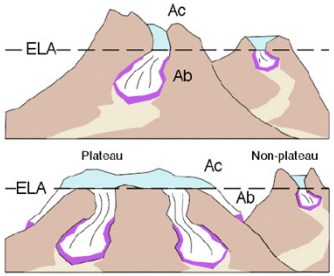
… une discusion au Würm et au-delà

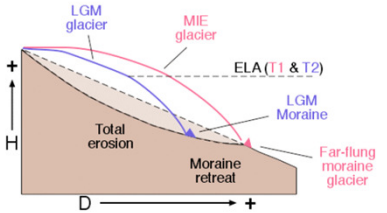
Valentí Turu (FMC)

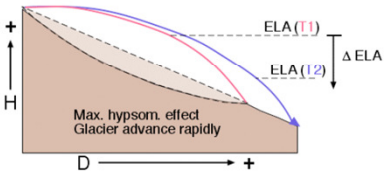


Huber (1987) modified

Les caractéristiques morphologiques et hypsometrie

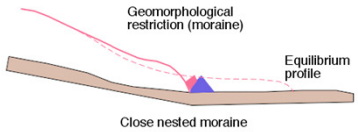




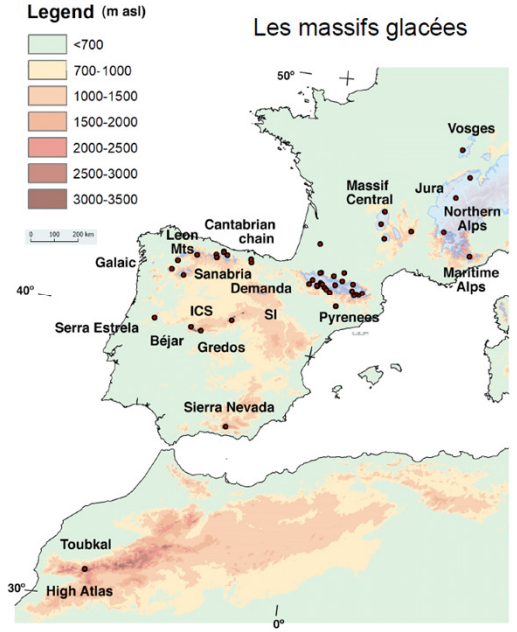


Terminal moraines complexes

Type 1: Close nested moraines
Type 2: Far-Flung Moraine + End moraines
Type 3: FFM + Nested moraines
Type 4: End-Moraines et possible FFM
Type 5: Close nested M. et possible FFM



Les massifs glacées



Modèles de glaciation

Type 1: Riss < Würm III
Type 2: Riss ≈ Würm
Type 3: Riss > Würm
Type 4: Riss ≠ Würm
Type 5: Termination I

Le LGM et le LLGM

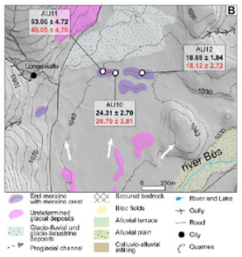
Last Local Glacial Max.

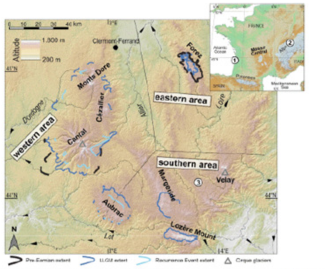
Type 1: LLGM = LGM
Type 2: LLGM ≈ LGM
Type 3: LLGM ≈ LGM
Type 4: LLGM > LGM
Type 5: LLGM < LGM

Glaciation type 1

MIS 2 glaciation

Aubrac Ice-cap





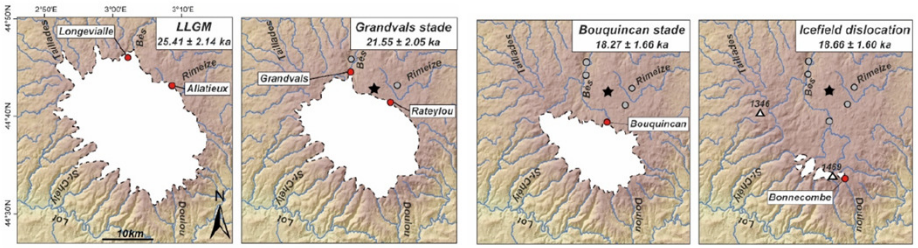


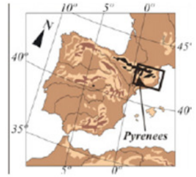
Fig. 8. Diachronic reconstructions of the Aubrac plateau icefield extent during MIS 2. Red dots are glacial landforms whose exposure ages indicate the minimum age of deglaciation. Glacial limits are uncertain and based on geomorphological (subglacially moulded morphologies and topographic constraints) and sedimentological observations (extension of till) (Poizat and Rousset, 1975; Veyret, 1978; Ancrenaz et al., 2020). The black star represents the location of the Roustière site (Gandouin et al., 2016; Ponel et al., 2016); note that it is located inside the LLGM outer limit (see Section 2.3 for further details). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

A. Ancrenaz, R. Braucher, E. Defive et al. Quaternary Science Reviews 285 (2022) 107500

Glaciation type 1

MIS 2 glaciation

Glaciers suralimentés par déflation



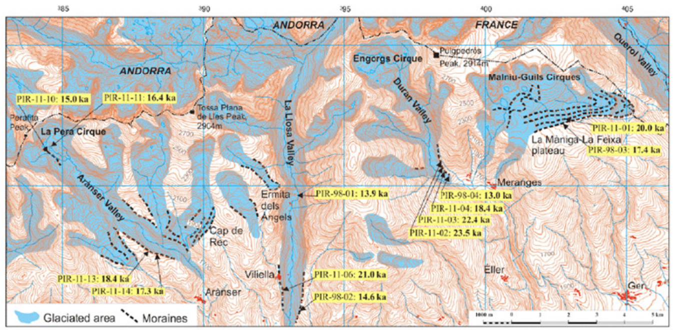
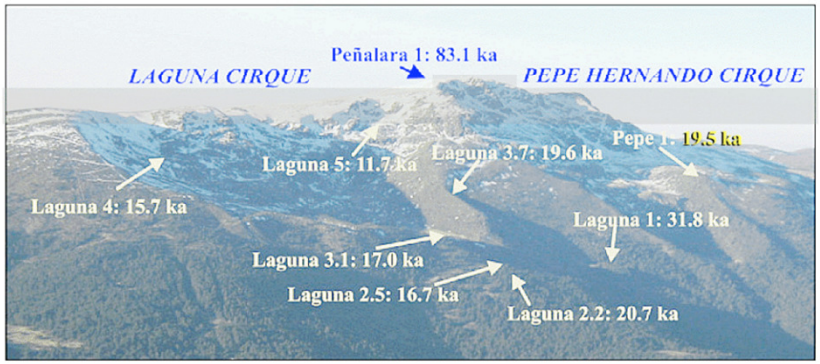


Fig. 2. Map of the study area with the MIE area, associated moraines and location of cosmogenic ^{36}Cl surface exposure sampling sites and results.

D. Palacios et al. / Geomorphology 231 (2015) 116–129

Glaciation type 1

Cirques glaciaires du Guadarrama

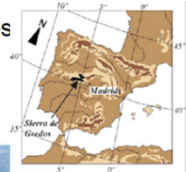


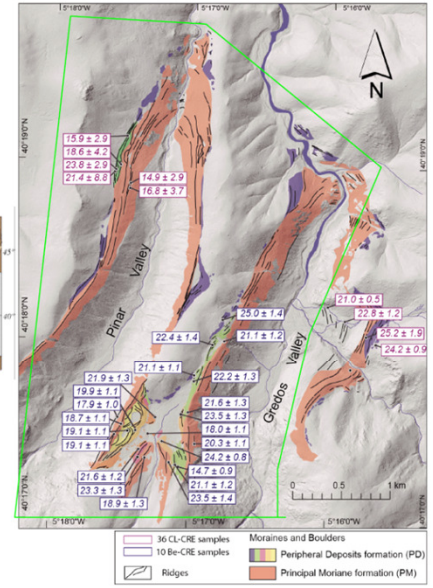
D. Palacios et al. / Geomorphology 139-140 (2012) 67–78

Glaciation type 1

MIS 2 glaciation

Gredos vallées glaciaires





Palacios et al (in preparation)

D. Palacios et al. / Geomorphology 177–178 (2012) 51–61

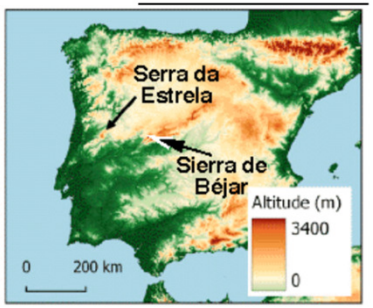
R. M. CARRASCO ET AL. 2020 JOURNAL OF MAPS 16,2, 790–804

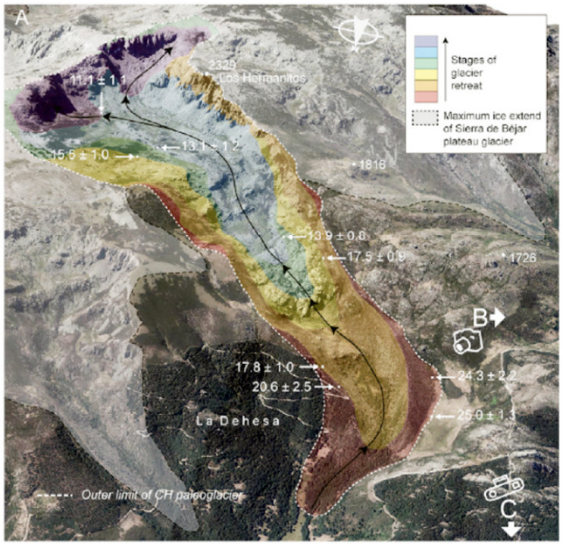
J.L. Granja-Bruña et al. Journal of Applied Geophysics 195 (2021) 104478

Glaciation type 1

MIS 2 glaciation

Béjar plateau et vallée glaciaire





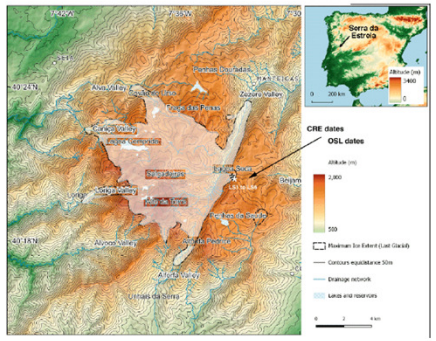
R.M. Carrasco et al. / Geomorphology 315 (2018) 1–16

Type 2 glaciation

Riss ≈ Würm

Ice-cap

G. Vieira, D. Palacios, N. Andrés et al. Geomorphology 388 (2021) 107781



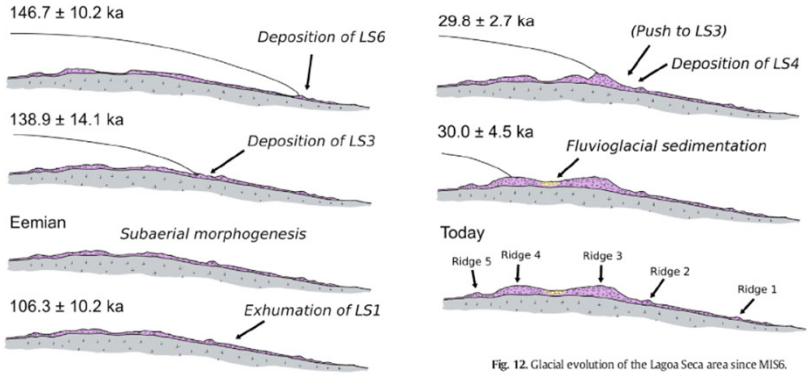
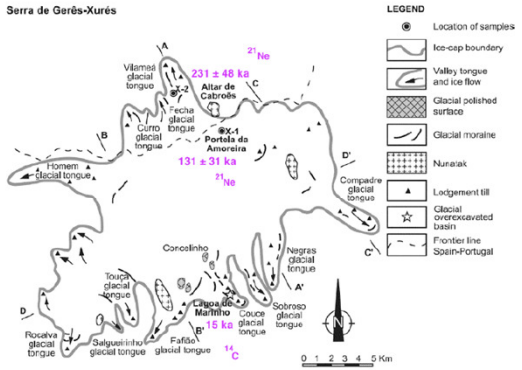


Fig. 12. Glacial evolution of the Lagoa Seca area since MIS6.

Type 2 glaciation

Riss ≈ Würm

Ice-cap



Type 2 glaciation

Riss ≈ Würm

Ice-cap

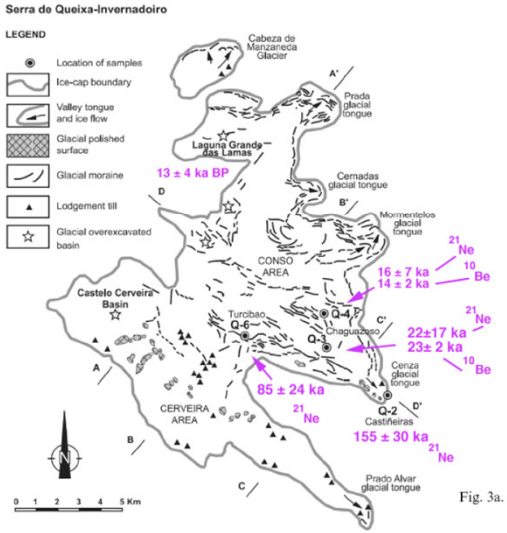
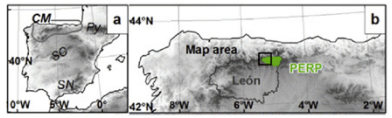


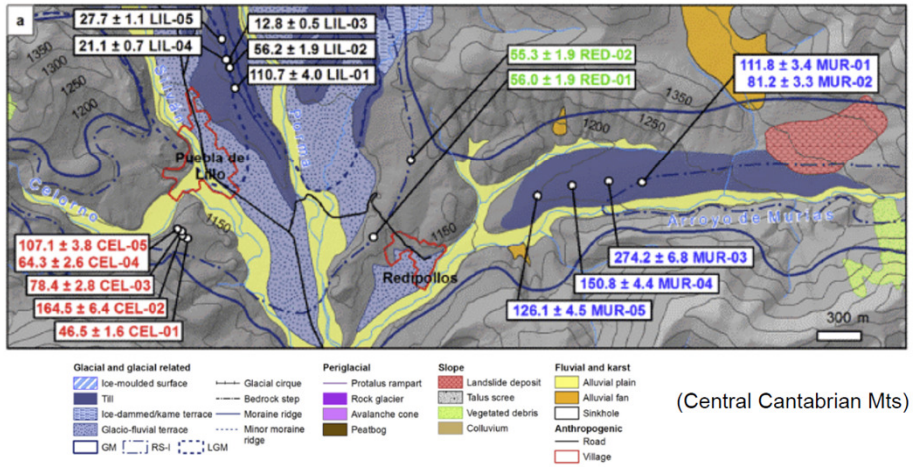
Fig. 3a.

Type 3 glaciation

Pseudo pléniglaciaire

L. Rodríguez-Rodríguez et al. / Quaternary Science Reviews 138 (2016) 31–48





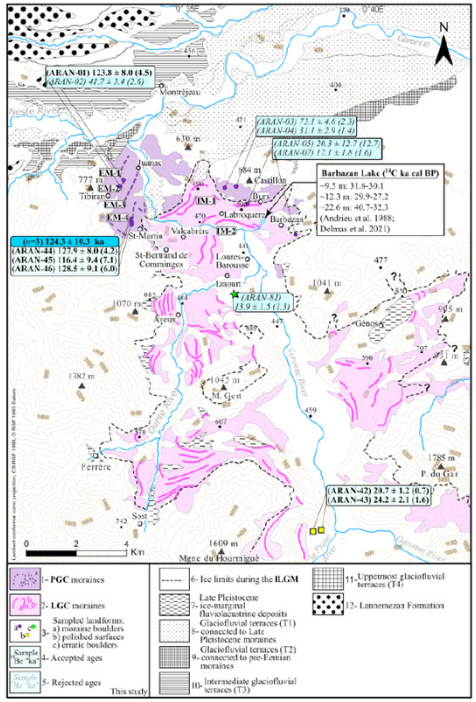
(Central Cantabrian Mts)

Fig. 5. Detailed geomorphological maps of the sampling sites noted in Fig. 2: (a) Terminal zone of the former Porma glacier (each color represent an specific landform as it is also shown in Fig. 6a); (b) valley headwall of the Silván tributary. Dated boulders are represented as white dots and ^{10}Be CRE ages are given in the white boxes (expressed in ka). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

Type 3 glaciation

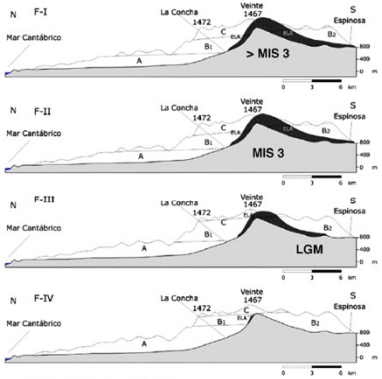
Pseudo pléniglaciaire

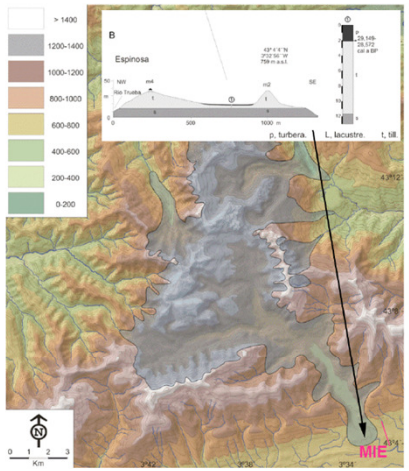
Riss ≈ Würm ≈ LGM

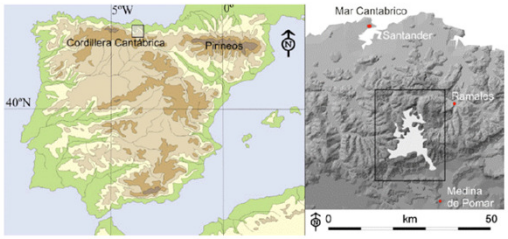


Fernandes et al (2021)
Environmental Earth Sciences (2021) 80:796

Type 4:
MIE ≈ LLGM > LGM



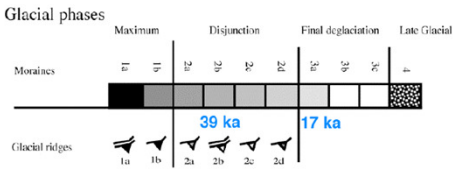




Trueba glacier (E Cantabrian Mts)

Serrano et al.
Cuaternario y Geomorfología (2013), 27 (1-2), 91-110

Type 4:
MIE > LLGM > LGM



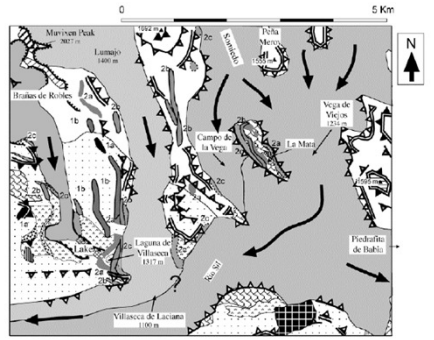
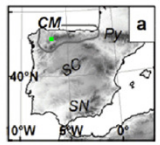
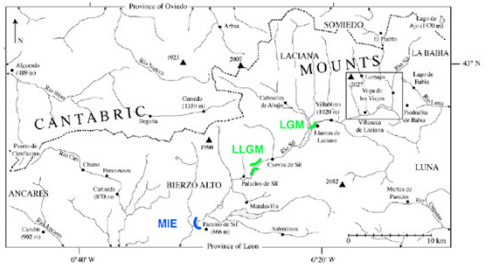


Fig. 4. Stratigraphic analysis of the core of Villaseca (V. Turu), Granulometry and sedimentology from A. Moreno and A. Navas.





Sil glacier (W Cantabrian Mts)

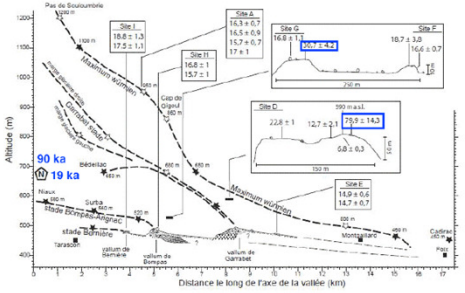
G. Jalut et al. / Palaeogeography, Palaeoclimatology, Palaeoecology 297 (2010) 330–350

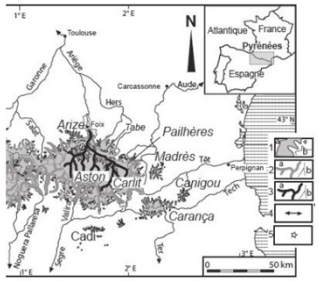
Type 4:
MIE > LLGM > LGM

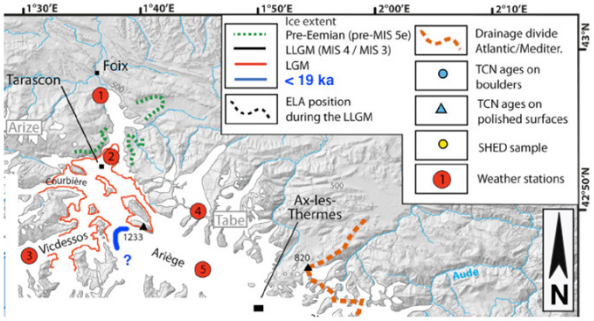
Ariège glacier (NE - Pyrénées)

T. Reixach, M. Delmas, R. Braucher et al. Quaternary Science Reviews 260 (2021) 106923

Delmas, M., Calvet, M., Gunnell, Y., Braucher, R., Bourlès, D., 2012. Les glaciations quaternaires dans les Pyrénées ariégeoises : approche historiographique, données paléogéographiques et chronologiques nouvelles. Quaternaire 23, 61–85.







Type 4: MIE = LLGM > LGM

P.D. Hughes et al. / Quaternary Science Reviews 180 (2018) 193–213

High Atlas

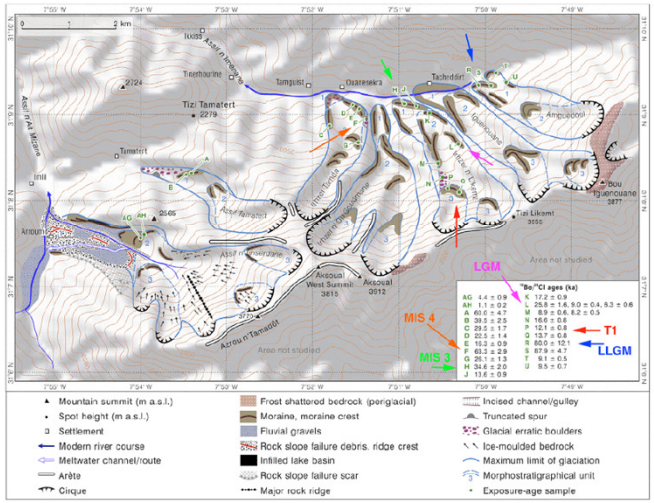
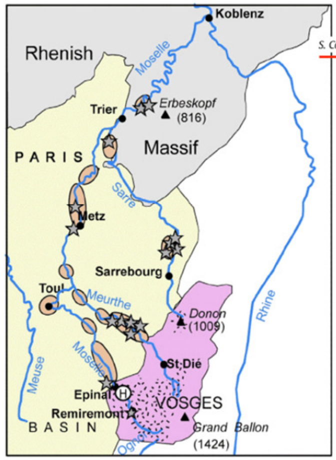
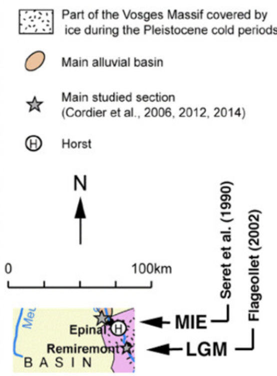


Fig. 3. Glacial geomorphological map of the seven glaciated valleys defined by Region 1 which covers the northern slopes of Azrou n'Tamadot (3770 m a.s.l.). Aksoual (3912 m and Bou Iguenouane (3877 m a.s.l.). The five easternmost glacial valleys drain into Assif n'Imenane, and the two westernmost drain into Assif Ait Mizane. Locations of cosmi sampling for exposure dating are given by alphabetic characters. Mapped moraines, labelled as Units 1, 2 and 3, are grouped in time-stratigraphical order from oldest to yo based on their respective exposure age distributions (see text for details).

Type 4: MIE > LGM



S. Cordier et al. / Quaternary Science Reviews 166 (2017) 57–73



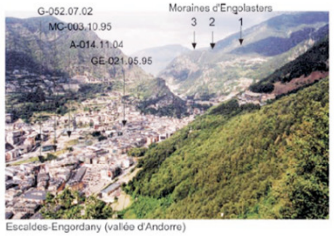
MIE et LGM asynchrones

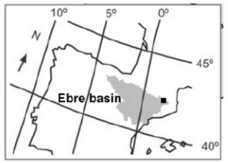
Seret, G., Dricot, E., Wansard, G., 1990. Evidence for an early glacial maximum in the French Vosges during the last glacial cycle. Nature 346, 453–456.

Flageollet, J.-C., 2002. Sur les traces des glaciers vosgiens. CNRS Editions. p. 212.

Type 4 glaciation:

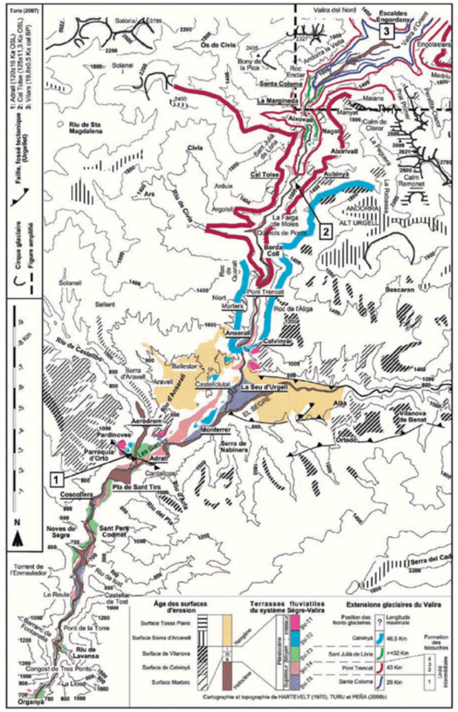
MIE > Riss < LLGM > LGM





Multi-phase glaciation

Quaternaire, **18**, (4), *2007*, p. 309-325



Type 5 glaciation
Système Ibérique

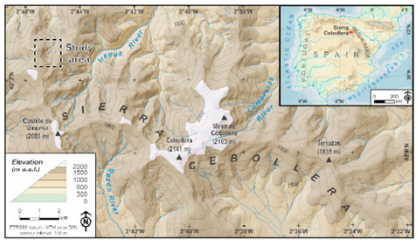


Fig. 1. Location of the study area in the Peña Negra Valley, Sierra Cebollera, Iberian Range, northern Iberian Peninsula.

No glacial landforms and morainic deposits older than the LGM have been found. Thus, only evidence of the last MIS2 glacial cycle is present in one of the main glacial valleys of the Sierra Cebollera.

J.M. García-Ruiz et al. / Geomorphology 362 (2020) 107195

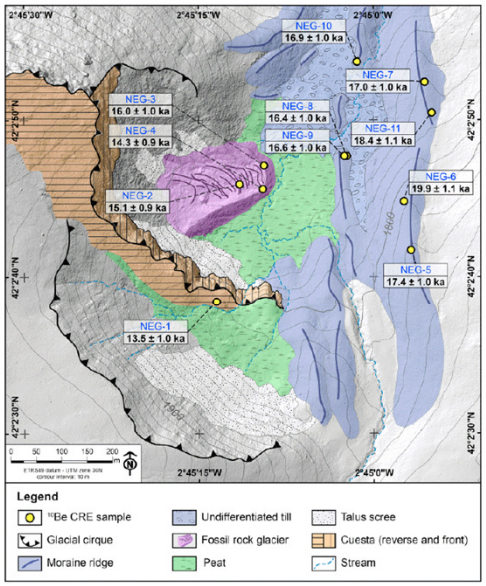


Fig. 2. Geomorphological map of the Peña Negra Valley and location of the CRE sampling sites.

Type 5 glaciation : Sanabria

T. Cowton et al. / Geomorphology 108 (2009) 282–291

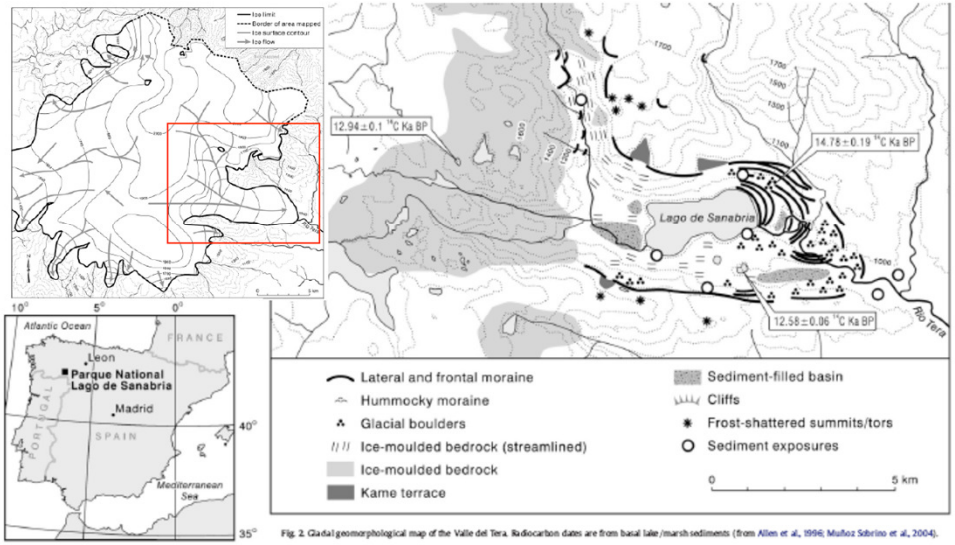


Fig. 3. Glacial geomorphological map of the Valle del Tera. Radiocarbon dates are from basal lake/marsh sediments (from Allen et al., 1996; Muñoz Sobrino et al., 2004).

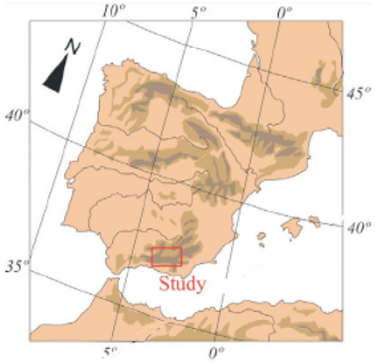
Type 5 glaciation

Sierra Nevada

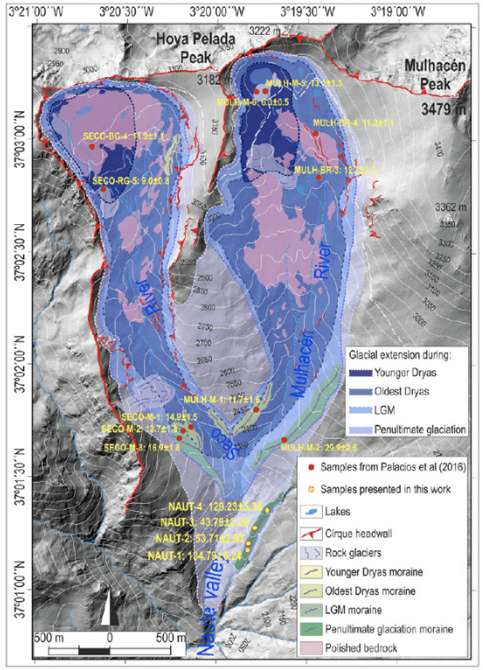
MIS 4 ages rejected by the authors

Riss > Würm

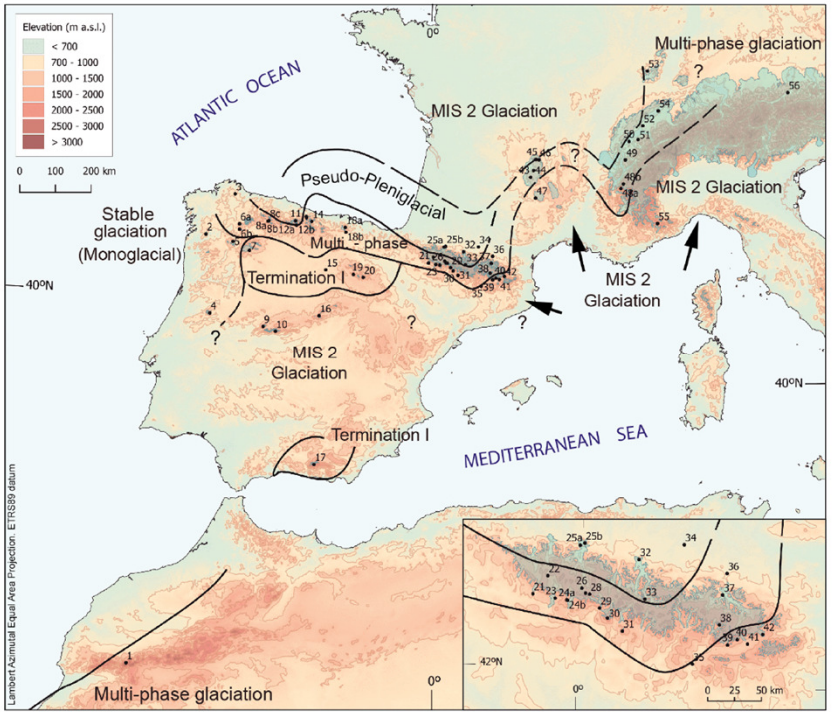
LGM < Termination I



D. Palacios et al. / Geomorphology 325 (2019) 103–118



Discussion



Légende

Glaciation types boundaries and sites: 1-Toubkal-4, 2-Serra do Xistral, 3-Sextas, 4-Serra da Estrela, 5-Queixa-Invernadoiro, 6a-Oribio Mounts, 6b-O Courel, 7-Sanabria, 8a-Castro Lake (Villaseca de Laciana), 8b-Laguna-A-Lucenza, 8c-Laguna Grande de Neila, 9-Bejar massif, 10-Gredos massif, 11-Brañagallones, 12a-, Porma/Lillo, 12b-Redipollos, 13a-Comeyas' polje, 13b-Hayéu l'Osu cave, 14-Campo Mayor, 15-Bibei, 16-Guadarrama, 17-Hoya Pelada, 18a-Ansón, 18b-Trueba, 19-Laguna de Miro (Villaseca Laciana), 20-Sierra Cebollera, 21-Villanúa(Castiello de Jaca, 22-Serra Faro de Avión, 23-Gavin, 24a-Llinàs de Broto, 24b-Viu, 25a-Soum d'Ech, 25b-Lourdes and Monge, 26-Garbarnie, 27-Pineta (Lago), 28-Larri hanged valley, 29-Salinas de Sin, 30-Cotiella, 31-Turbon, 32-Barbazán, Garonne paleolake, 33-Joèu, 34-Têt – La Borde, 35-Segre- TQ4 (Organyà), 36-Tournac, 37-Niaux cave, 38-Roc del Quer, 39-La Llosa/Duran, 40-Malniu, 41-Querol/Puigcerda, 42-Tamboreurets, 43-Cantal, 44-Lugarde (Cantal), 45-Mont Dore, 46-Couze Chambon (Auvernat), 47-Aubrac, 48a-Isère-Grenoble, 48b-Trieves/Avignonet, 49-Montagne de Bange, 50-Genève, 51-Ramble de Chablais, 52-Biolet-Orjulaz, 53-Vosges massif, 54-Finsterhennen, 55-Maritime Alps, 56-Unterangerberg. Arrows, influence from the Mediterranean over the SE of France and the NE of Spain.

Les caractéristiques glaciologiques

ELA

Type 1:	Riss > Würm I ≈ Würm II >> Würm III
Type 2 and 3:	Riss ≈ Würm I ≈ Würm II ≈ Würm III
Type 4:	Riss ≠ Würm I > Würm II < Würm III
Type 5:	Riss ≠ Würm I > Würm II > Würm III ≈ Termination I

Humidité

Type 1:	Würm II < Würm III
Type 2 & 3:	Riss ≈ Würm I ≈ Würm II ≈ Würm III
Type 4:	Riss ≠ Würm I < Würm II < Würm III
Type 5:	Würm II < Würm III < Termination I

Érosion

Type 1:	Würm III > précédent
Type 2 & 3:	Riss > Würm I ≈ Würm II ≈ Würm III
Type 4:	Riss > Würm I ≈ Würm II < Würm III
Type 5:	Würm I ≈ Würm II < Würm III ≈ Termination I

Merci