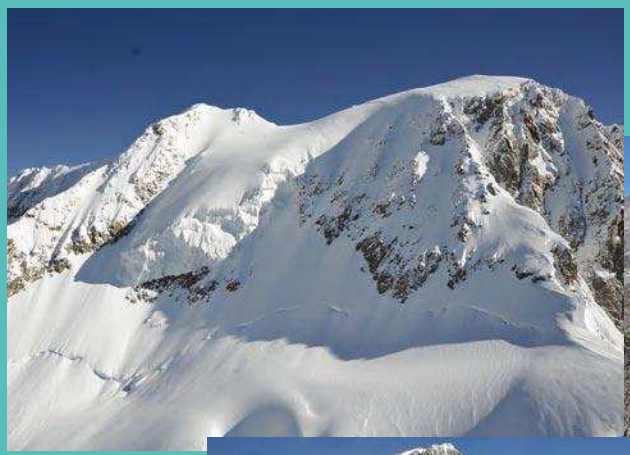
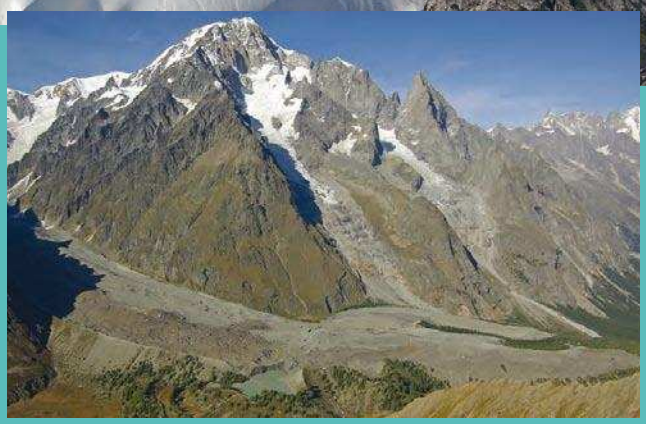
IGS
alpes occidentales

société internationale de glaciologie
section des alpes occidentales

Tournée IGS-SAO 2015

Courmayeur
Val Veny
Val Ferret





Programme

Jeudi 27 Août 2015

Introduction avec le panorama depuis le Mt Chétif

- RDV à Courmayeur à 10h
Dépôt des bagages au refuge-auberge du Monte Bianco dans le Val Veny (accès en voiture) Refuge de 56 place en chambres de 2 ou 4 places + 1 dortoir de 14 places
Site web : http://www.rifugiomontebianco.com/rifugio.html

- Montée en voiture à Pré de Pascal , puis départ pour le Mt Chétif (env. 2h de marche, 400 m de dénivelé)

- Pique-nique (à prévoir par les participants)

- Panorama sur le secteur du Glacier de la Brenva et de son écroulement.

- Redescente et arrêt à Notre Dame de la Guérison : panorama sur la déformation gravitaire profonde du Mont de la Saxe (>8 M m3) et sa partie très active (1.6 Mm3). Problématique du risque avec les villages d'Entrèves et de la Palud, les axes routiers internationaux d'accès au tunnel du MB, et l'écoulement de la Doire de Ferret.

- Retour aux voitures et quartier libre à Courmayeur (selon l'heure de retour)

- Retour au refuge et dîner

Vendredi 28 août
Sentier Balcon Val Veny

- Départ à 8h00 du refuge

- Montée en voiture à Pré de Pascal, puis transfert en 4x4 jusqu'au Col Checrouit.

- parcours du sentier balcon, environ 500 m de dénivelé, avec nombreux panoramas sur les glaciers du versant Sud du massif du Mont Blanc.

- Redescente sur le plan Combal et l'amphithéâtre morainique du Miage.

- Montée vers le lac du Miage et son lac juxtaglaciaire

- Accès à la moraine latérale et redescente par le glacier (glacier noir, pas besoin d'équipements spéciaux!) et le Jardin du Miage.

- Retour en voiture vers le refuge.

Samedi 29 août : Sentier Balcon Val Ferret

- Départ 8h00 du refuge

- Accès en voiture au Val Ferret.

- Parcours à pied du sentier balcon, environ 500 m de dénivelé, avec nombreux panoramas sur les glaciers du versant du massif du Mont Blanc, complémentaires de la journée du vendredi.

- Retour en bus depuis l'Arp Nouva jusqu'aux voitures, puis au refuge.

Dimanche 30 août : Glacier de Pré de Bard

- Départ 9h00 du refuge

- Accès en voiture au parking de l'Arp Nouva (Val Ferret).

- Montée à pied jusqu'au refuge Elena.

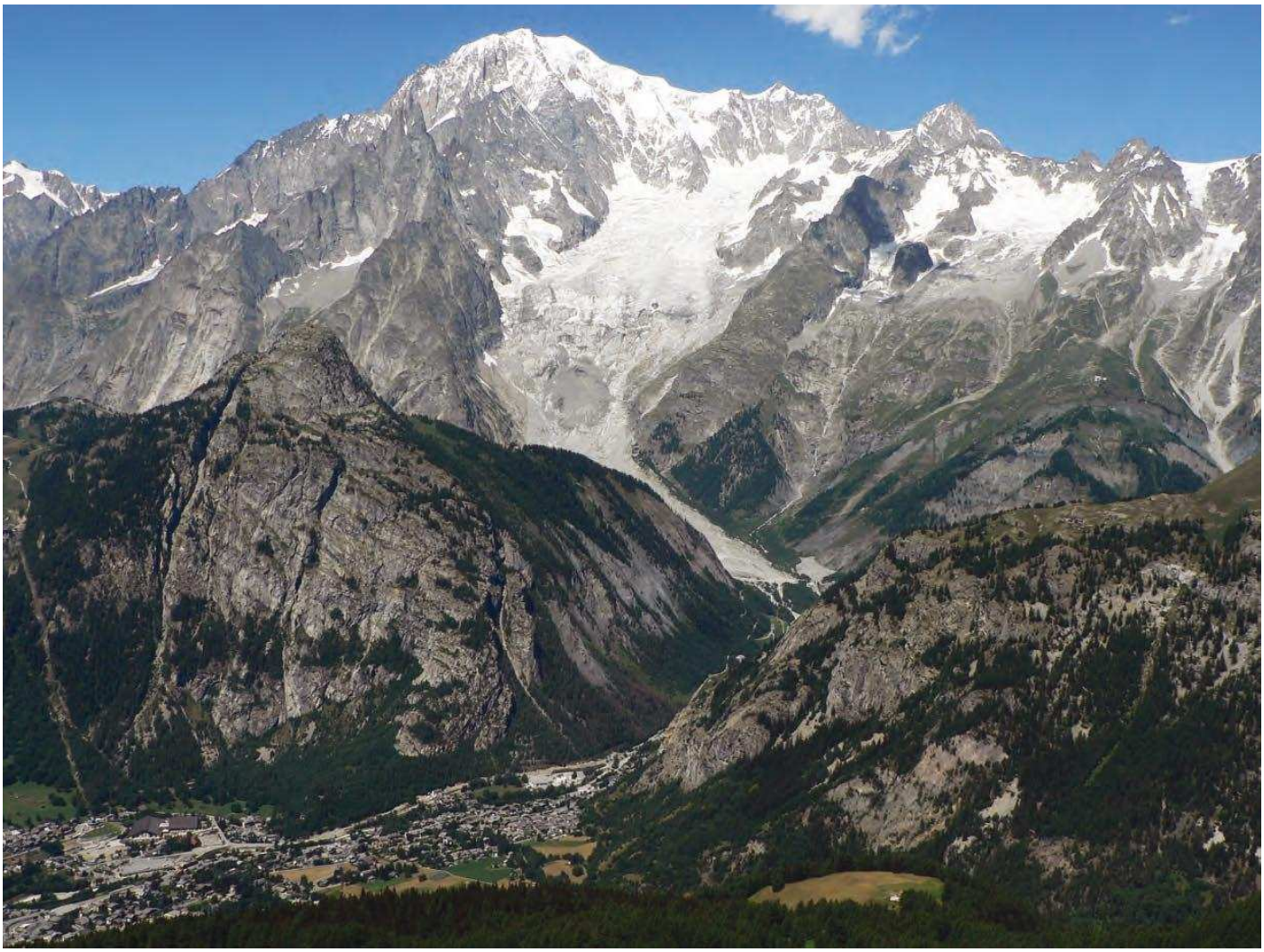
- Pique-nique avec panorama sur le glacier de Pré de Bard

- Descente vers la station hydrologique EDYTEM dans la marge proglaciaire de Pré de Bard

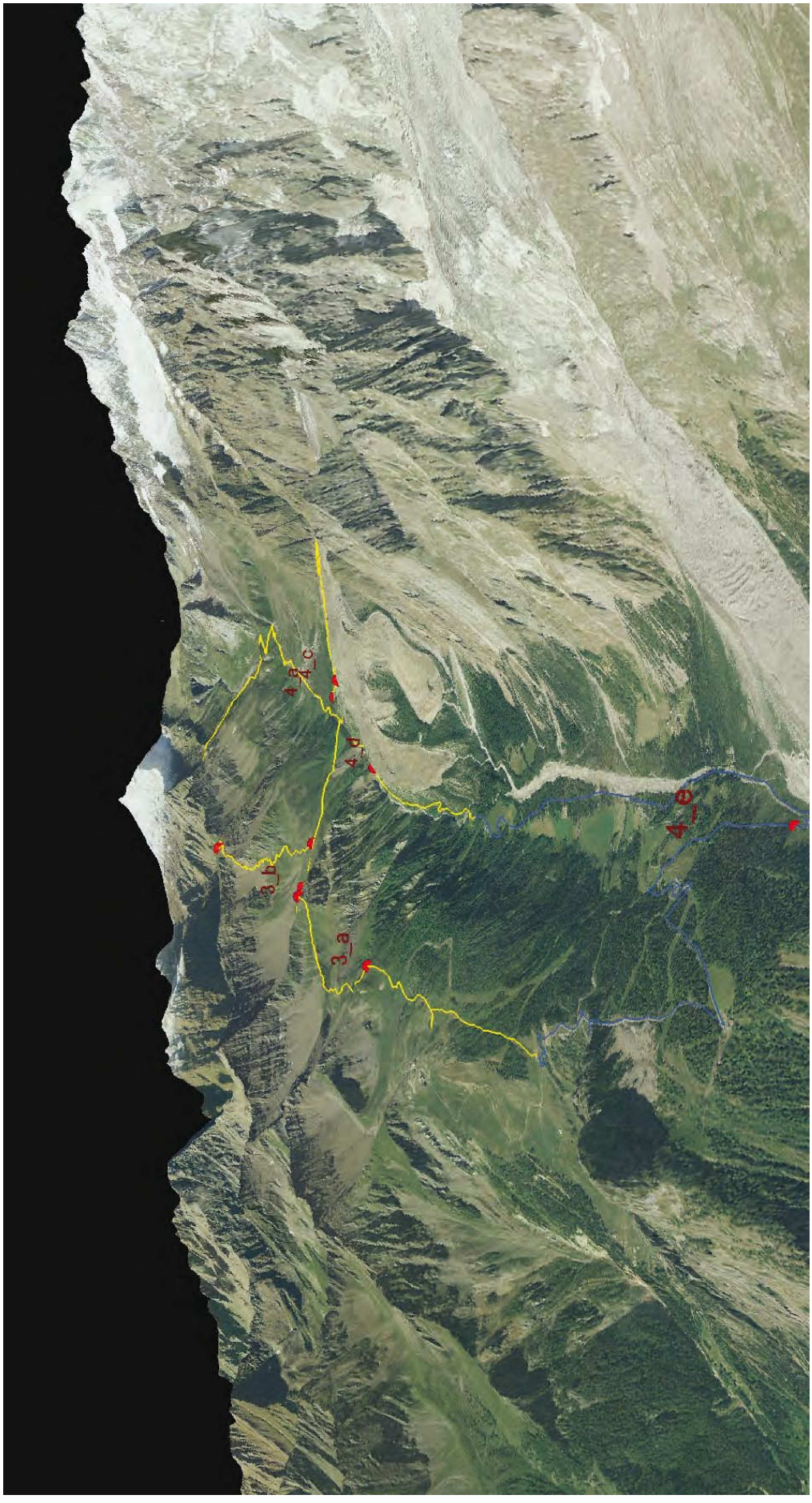
- Retour aux voitures et dispersion de la tournée.

Les documents de ce support sont issus du livret guide : INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY, PARIS 2013. POST-CONFERENCE EXCURSIONS P6A (TWO FIRST DAYS) & P6B FIELD TRIP GUIDE

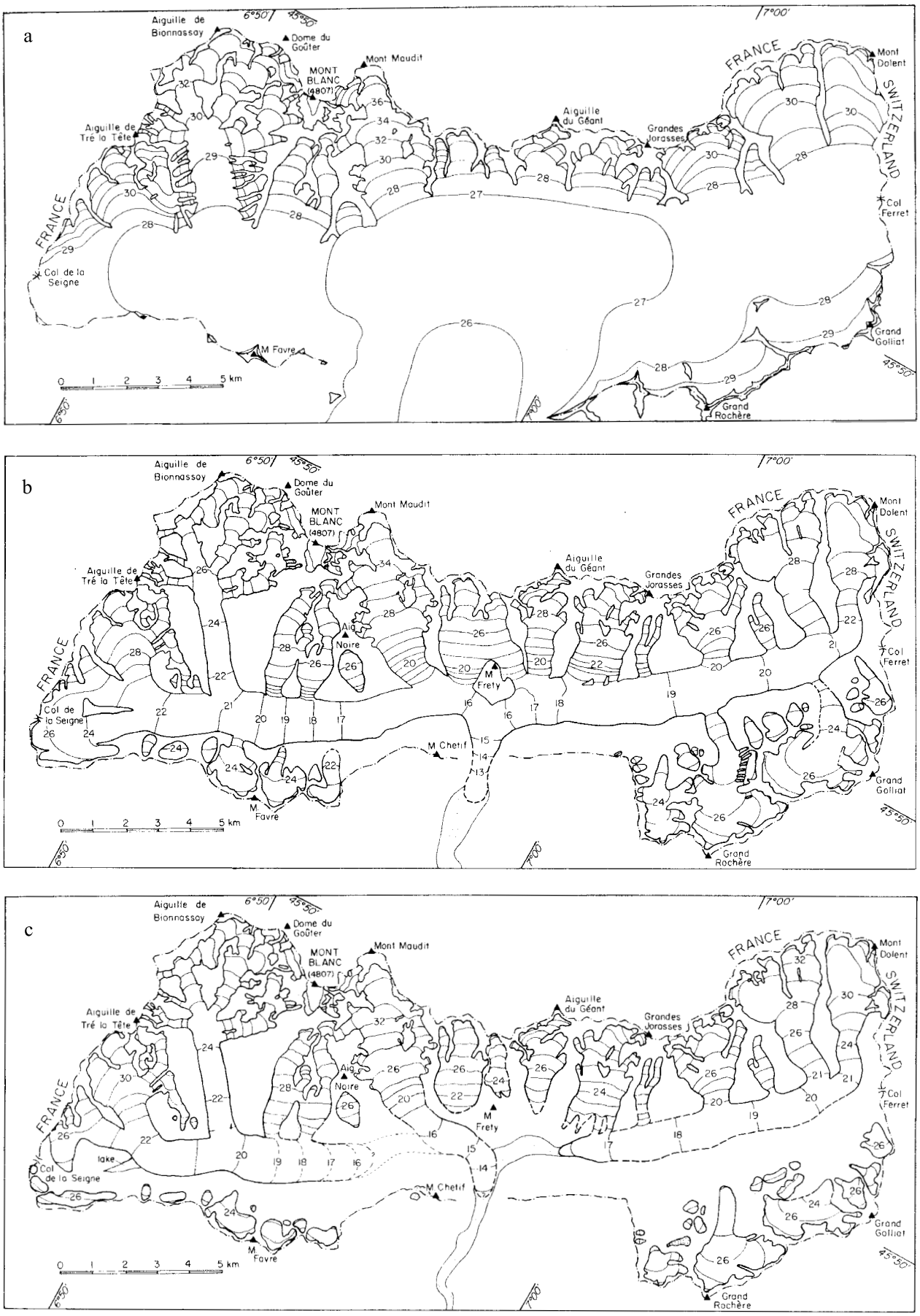
Val Veny



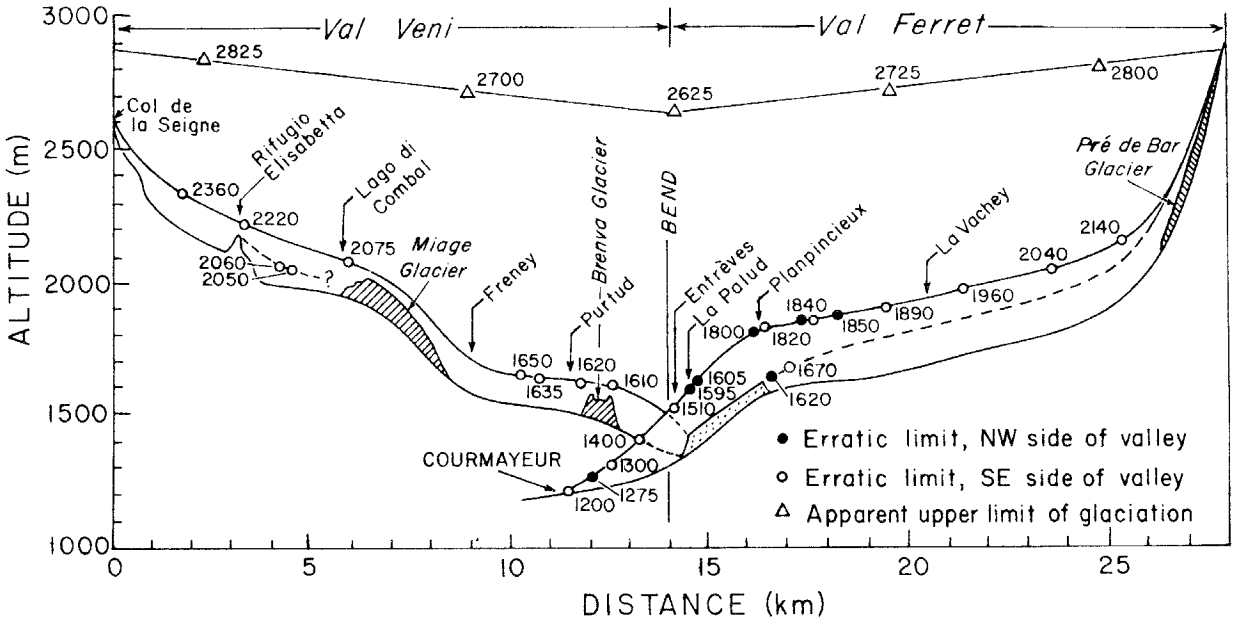
A view of the SE side of the Mont Blanc massif. In the background, the Mont Blanc summit towering above the Glacier de la Brenva; in the foreground, from left to right: Mont Chétif, and Mont de la Saxe; Courmayeur is lying in the valley.



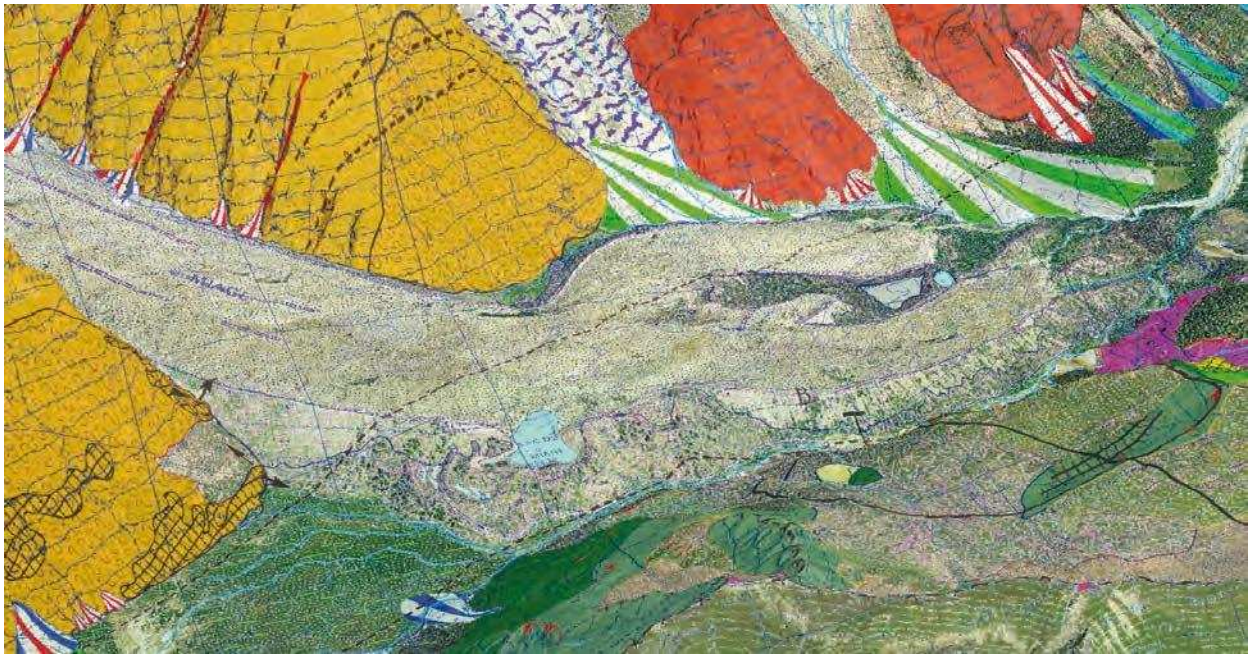
1- 2.5 Ortophotographic model of the Val Veny with the route of the field trip IAG-P6B, third day.



2- Reconstruction of the LGM (a), Courmayeur (= Daun, b) and Planpincieux (= Egesen, c) glacial stages in Val Veny and Val Ferret (Porter & Orombelli, 1982).

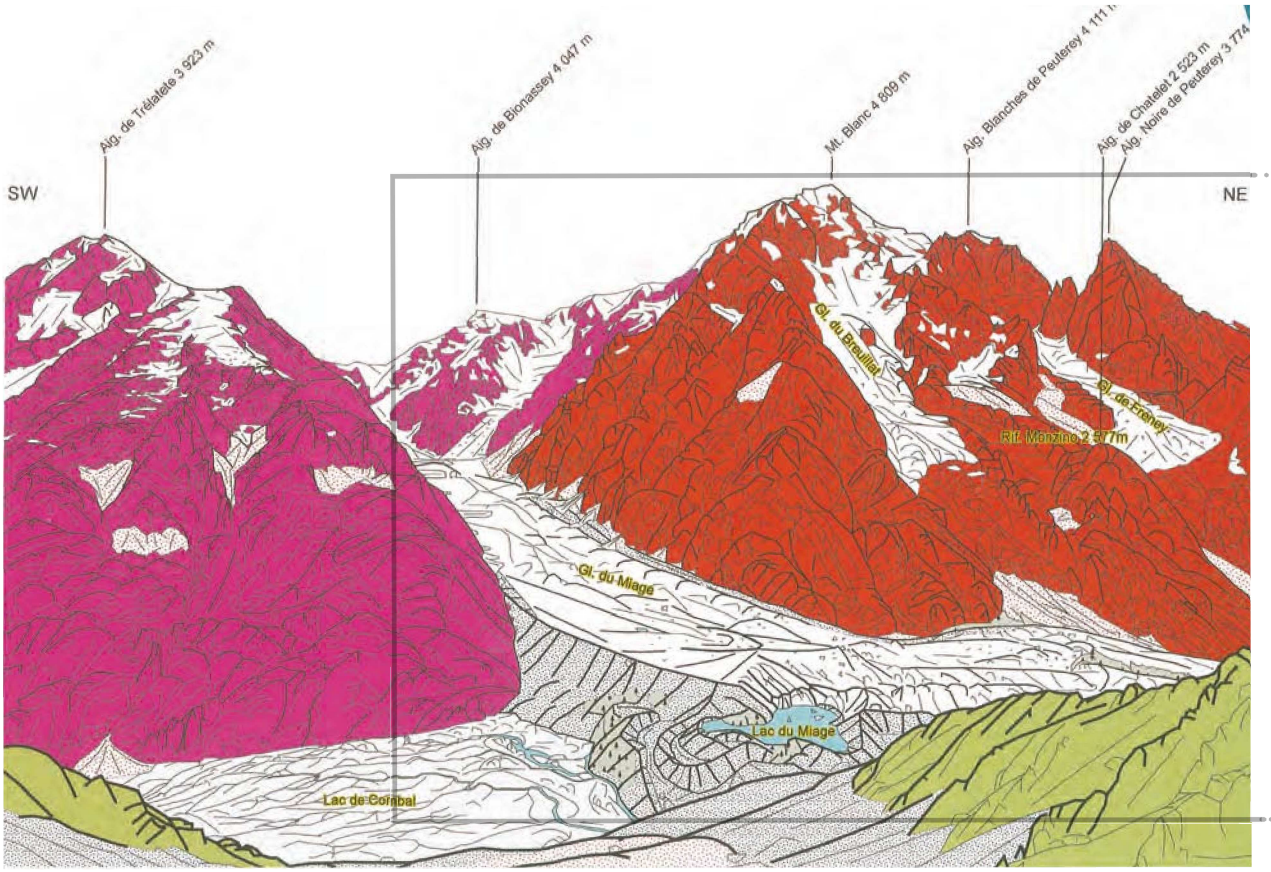


3- Trimlines and upper erratic limits in Val Veny and Val Ferret (Porter & Orombelli, 1982).



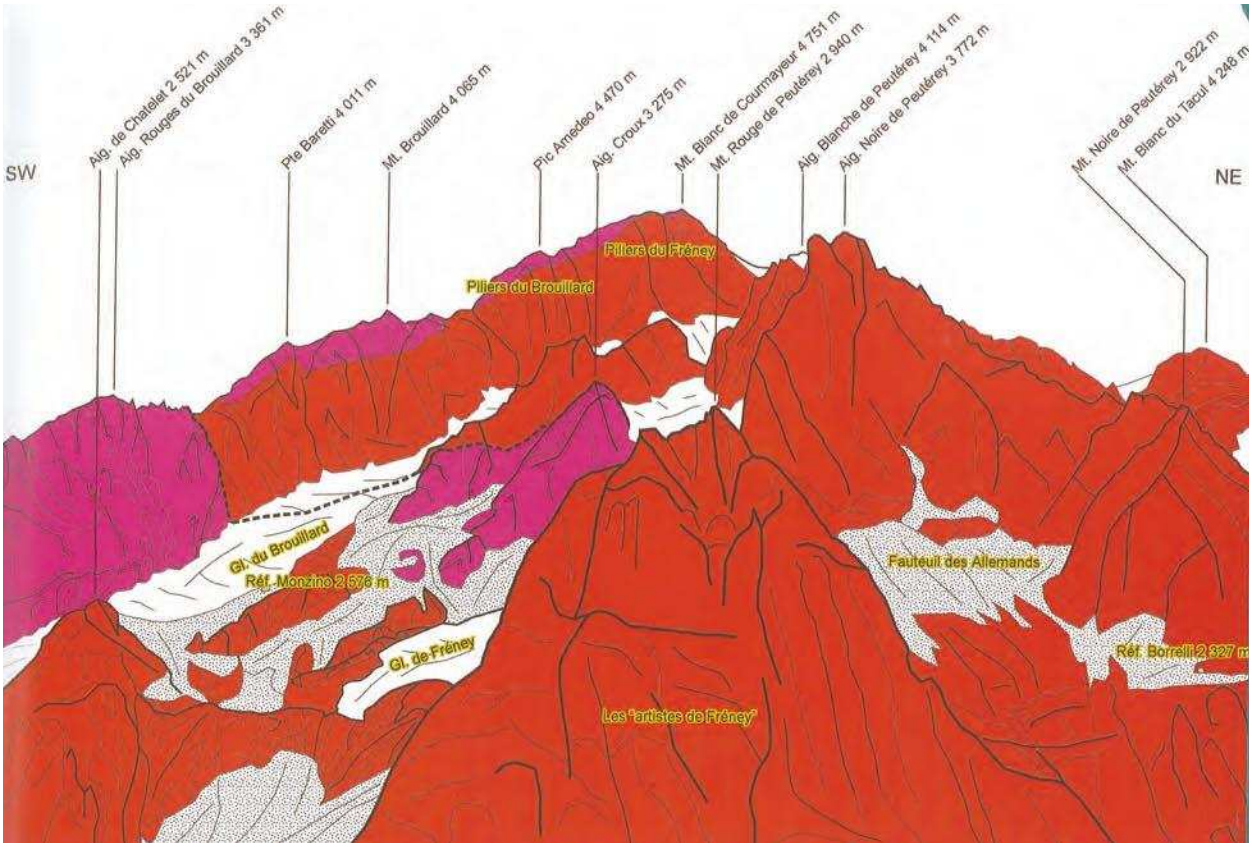
4- Extract of the geomorphological map of the Val Veny (Bacenetti, 2010)

5- Panorama of Mont Blanc side in the Val Veny from Mont Fortin, with Mont Blanc summit, debris-covered Glacier du Miage, ice-marginal lake Miage, and moraine-dammed palaeolake Combal.



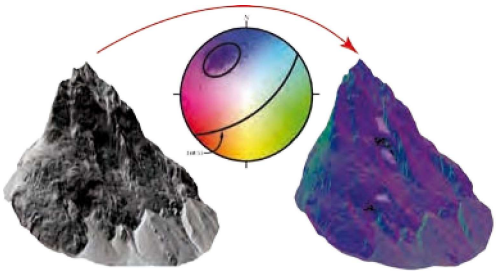
6- Geological panorama of the SE side of the Mont Blanc massif from the M. Fortin (pink: gneiss; red: granite) (Amelot and Bolognini, 2008).

7- Mont Rouge de Peuterey with its numerous rockfall scars.

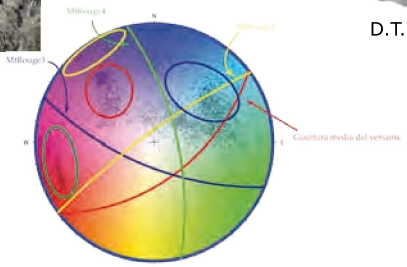


8- Geological panorama of the SE side of the Mont Blanc massif from the Col Checrouit (pink: gneiss; red: granite) (Amelot and Bolognini, 2008).

ANALYSIS POTENTIAL FAILURE SURFACE of the MONT ROUGE de PEUTEREY

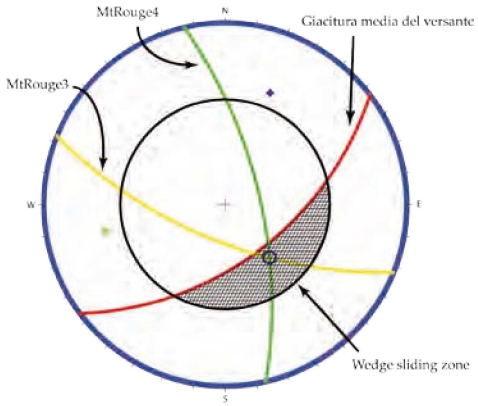


D.T.M. Hillshade D.T.M. Coltop 3D



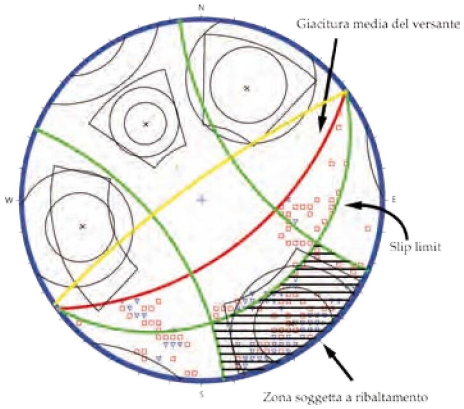
Joint Set	DipDirection	Dip
Mt Rouge1	145	55
Mt Rouge2	324	80
Mt Rouge3	202	67
Mt Rouge4	77	68

Wedge sliding



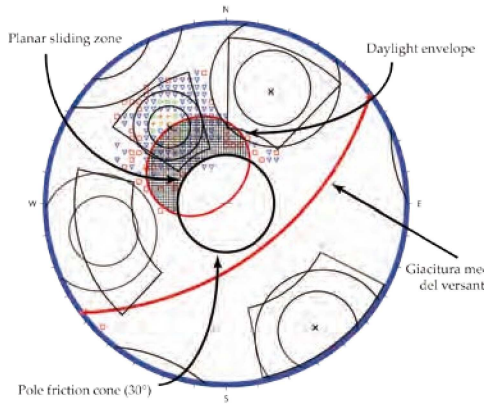
9a- Analysis potential failure surface of the Mont Rouge de Peuterey (Bacenetti, 2010).

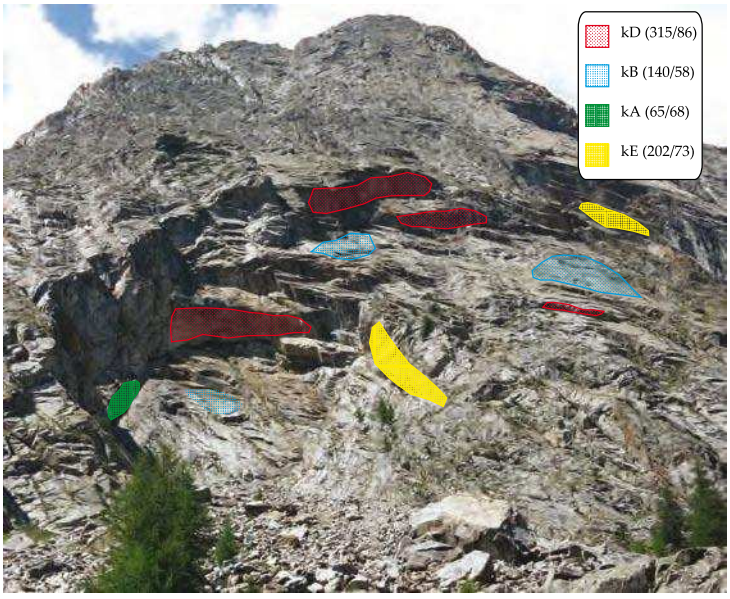
Toppling

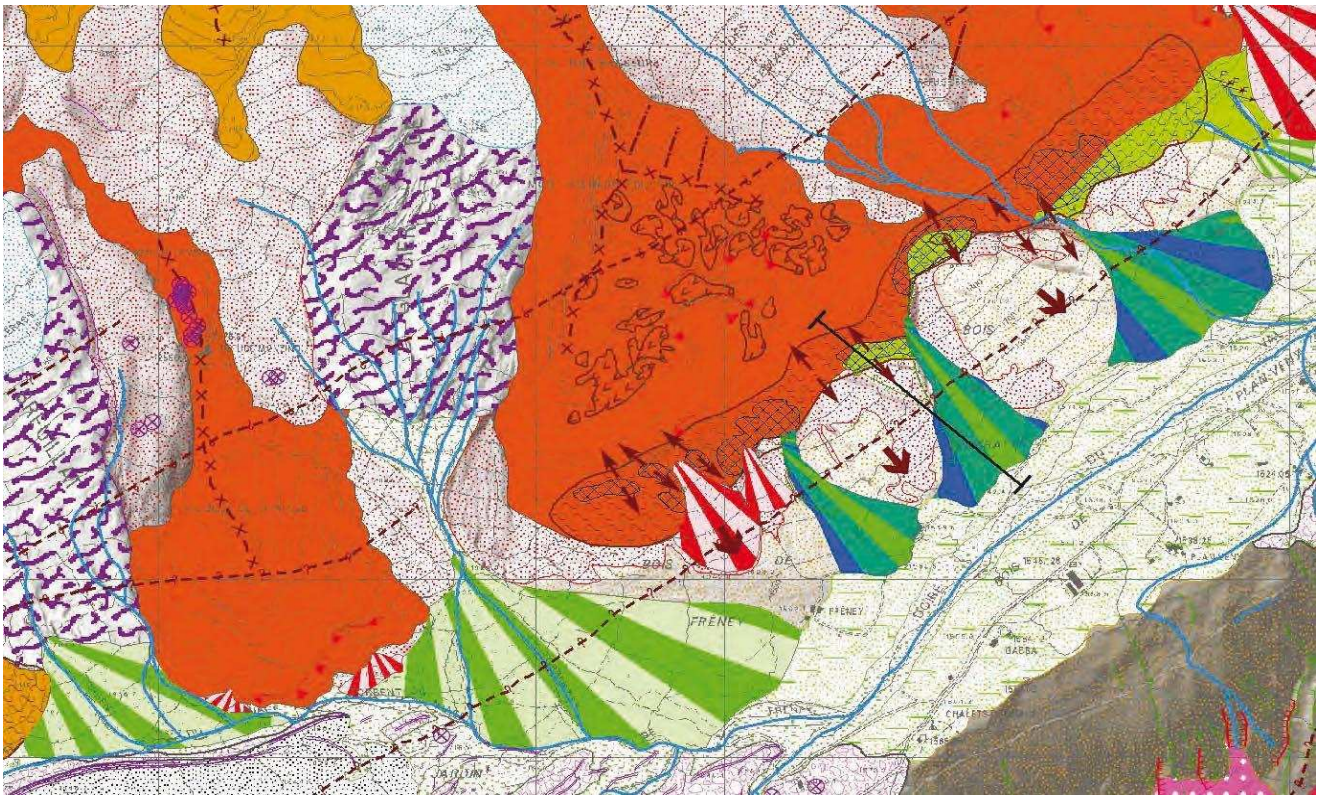


9b- Focus of the detachment of the Mont Rouge de Peuterey (Bacenetti, 2010)

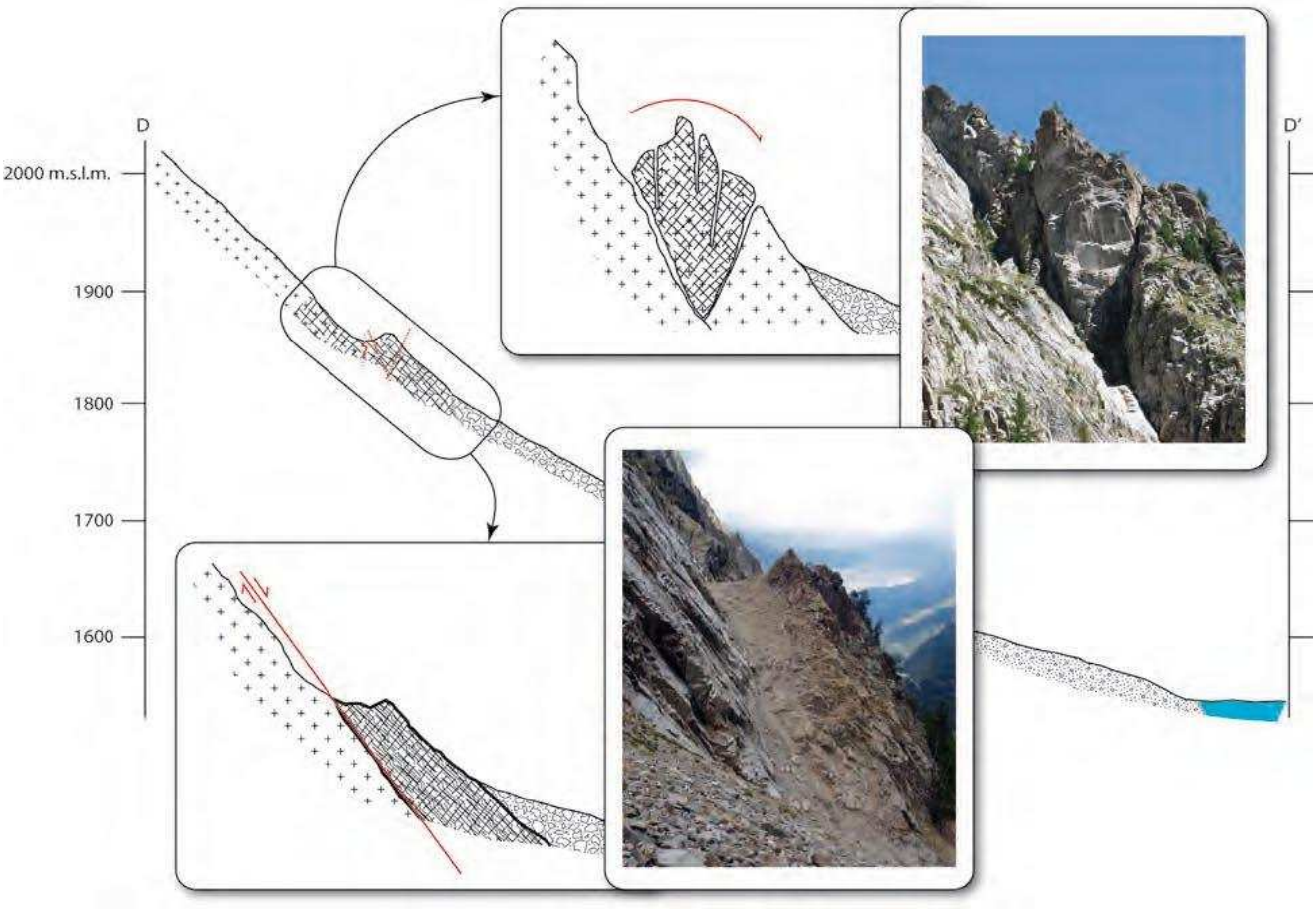
Planar sliding



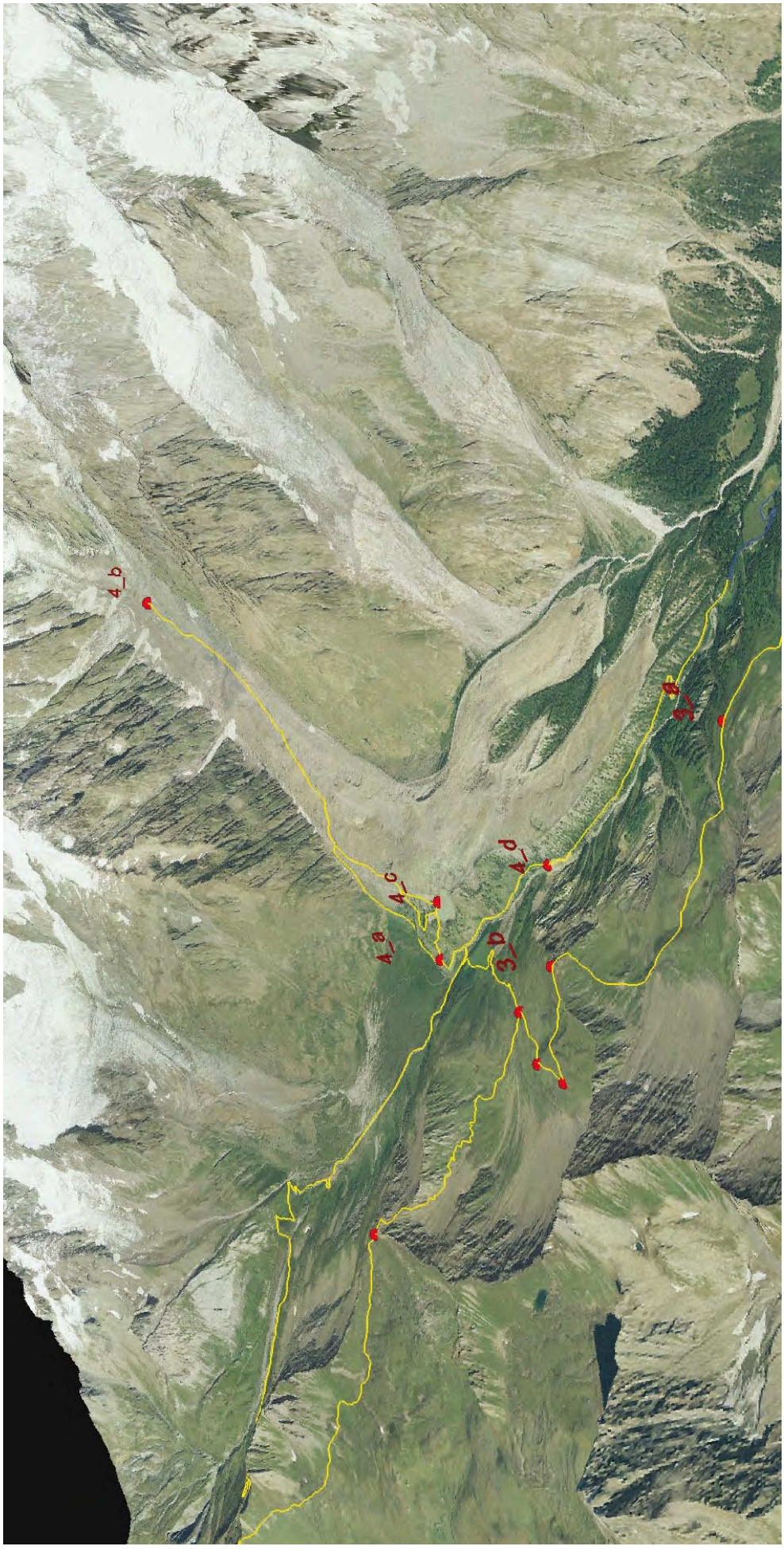




10- Extract of the geomorphological map of the Val Veny (Bacenetti, 2010).



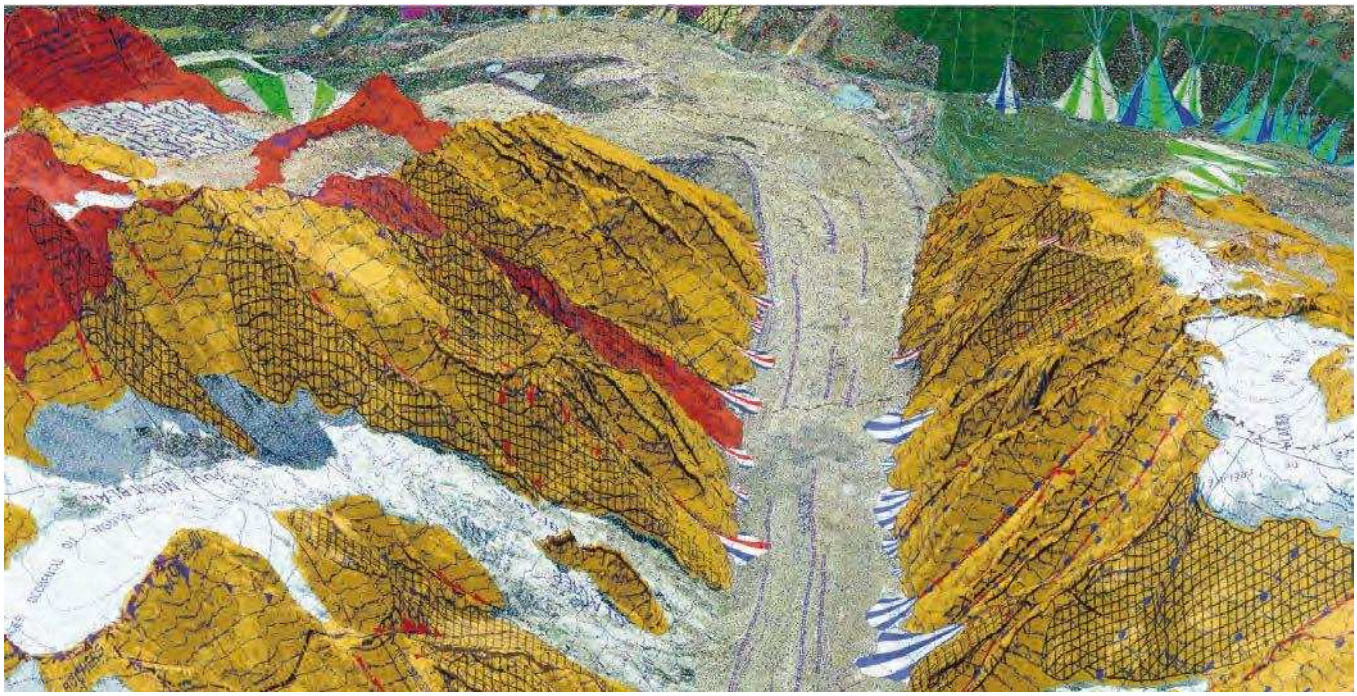
11- Schematic morpho-tectonic setting and cross sections of the left side of Val Veny. (Bacenetti, 2010).



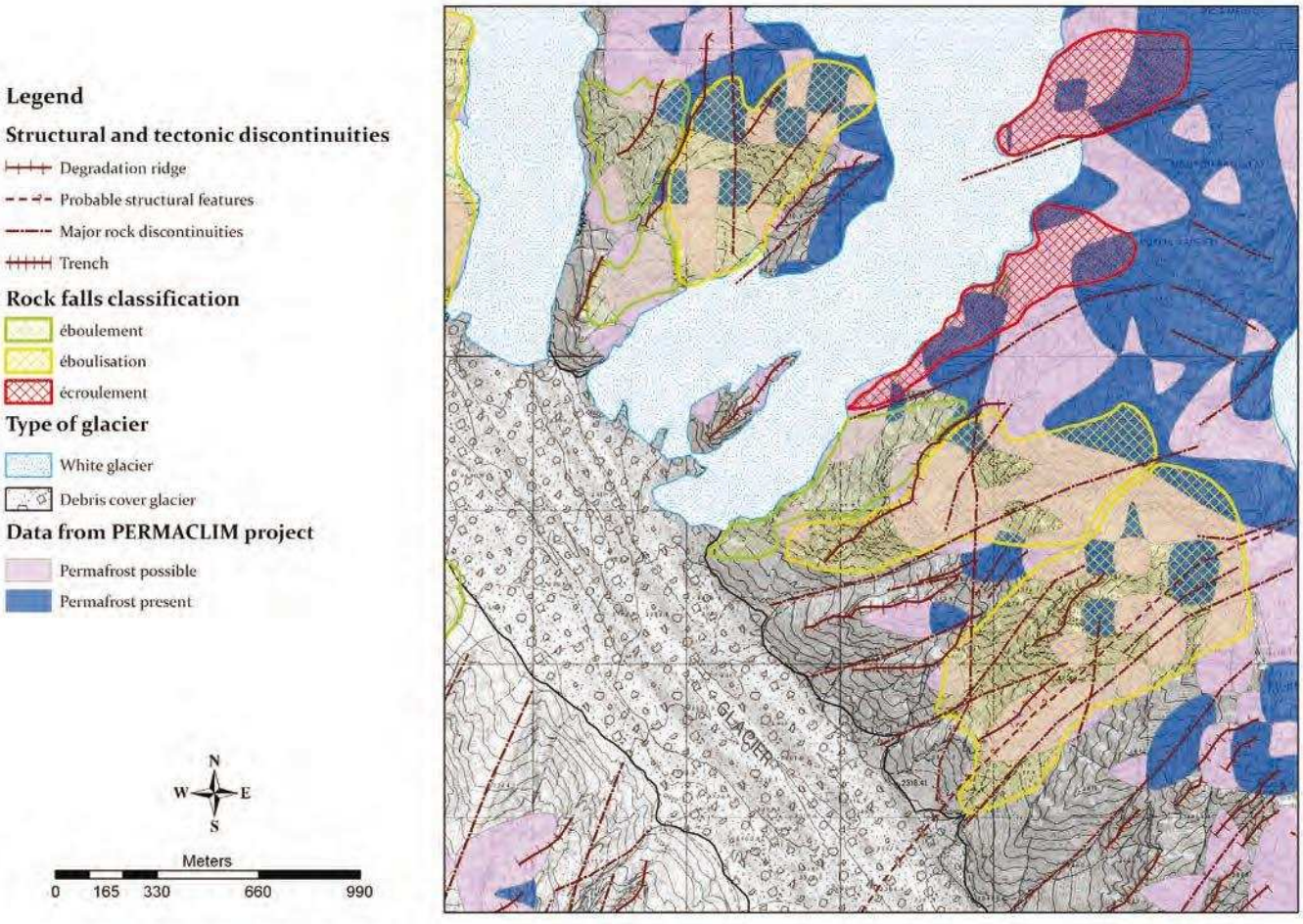
1- 2.5 Ortophotographic model of the Val Veny with the route of the field trip IAG-P6B, fourth day

2- Glacier de la Lex Blanche: 2009 and Little Ice Age (c. 1824) extensions (lithography in Raoul-Rochette, 1826)

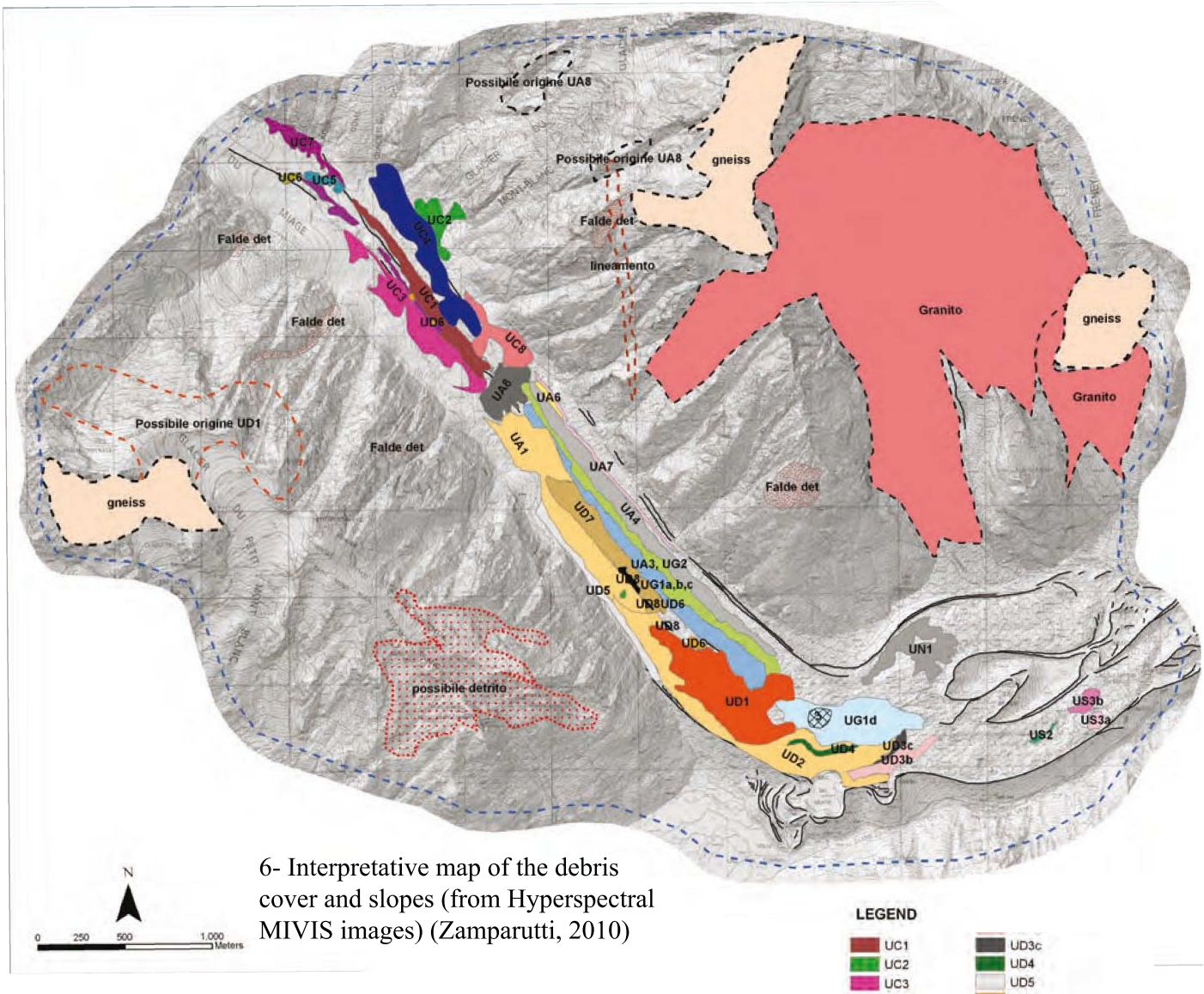
3- Extract of the geomorphological map of the middle Val Veny (Bacenetti, 2010)



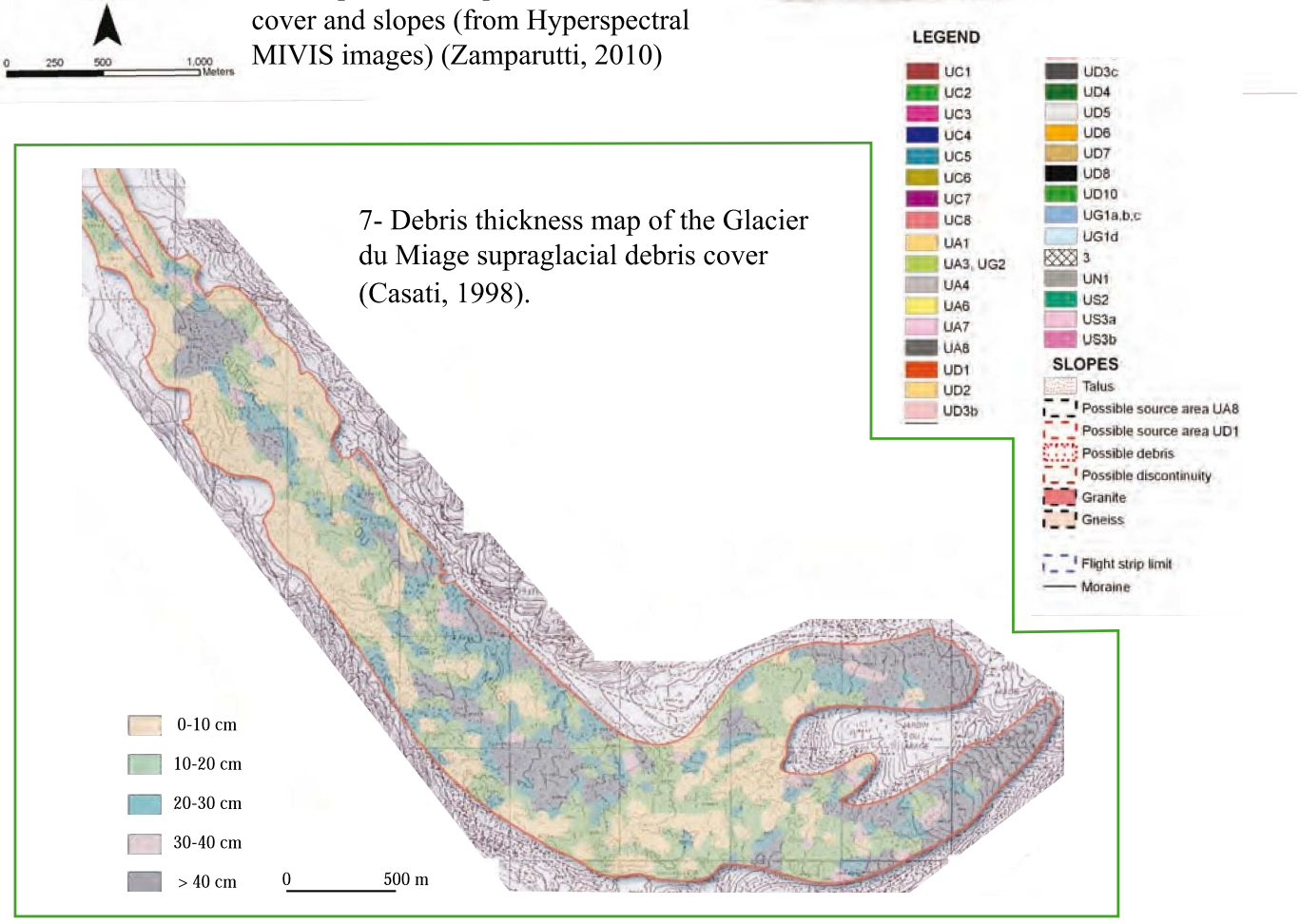
4- Extract of the geomorphological map of the Val Veny, Miage Valley sector (Bacenetti, 2010)



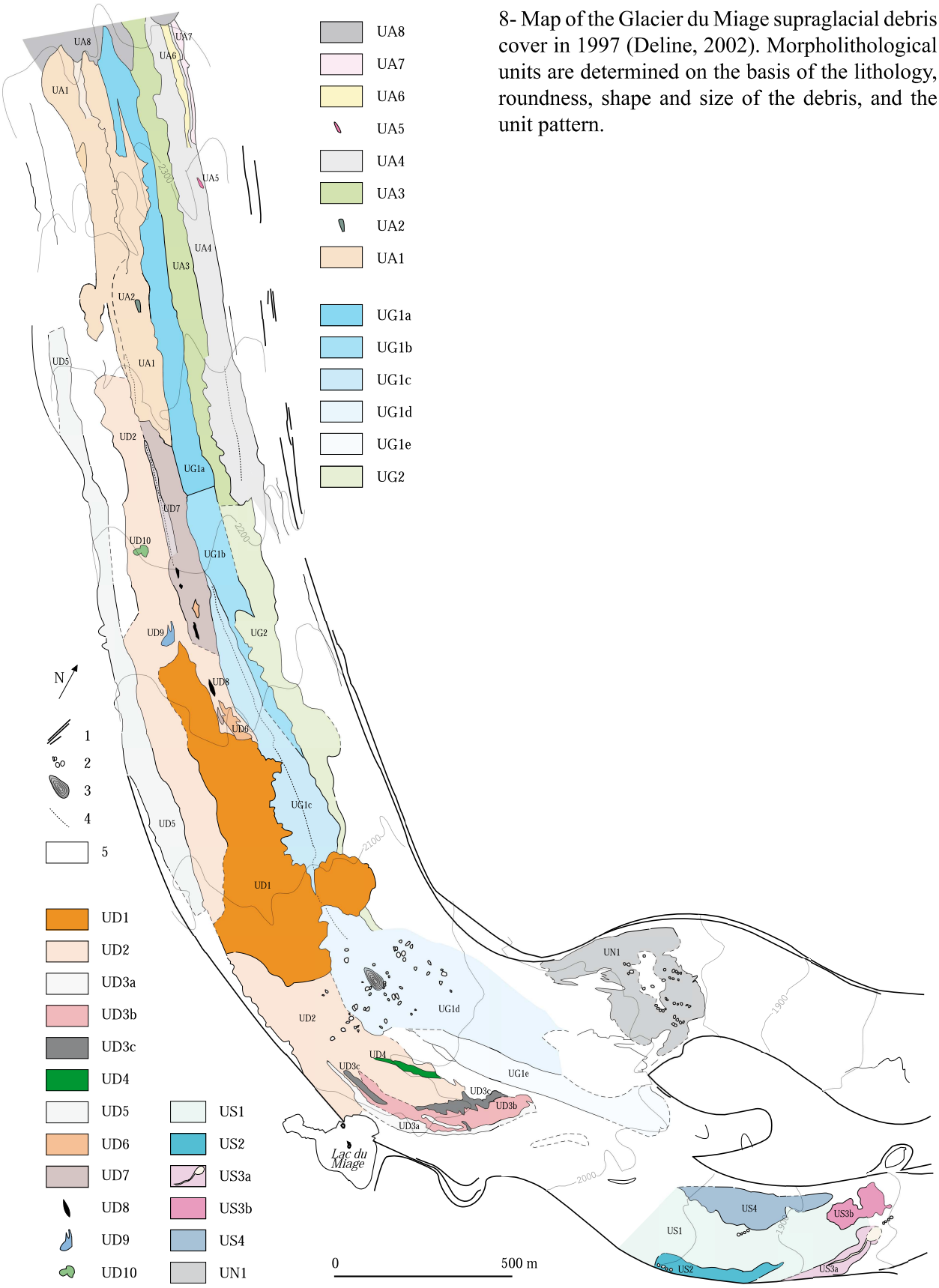
5- Map of interaction between structural setting, rock falls and permafrost distribution models (Giardino et al., 2011)



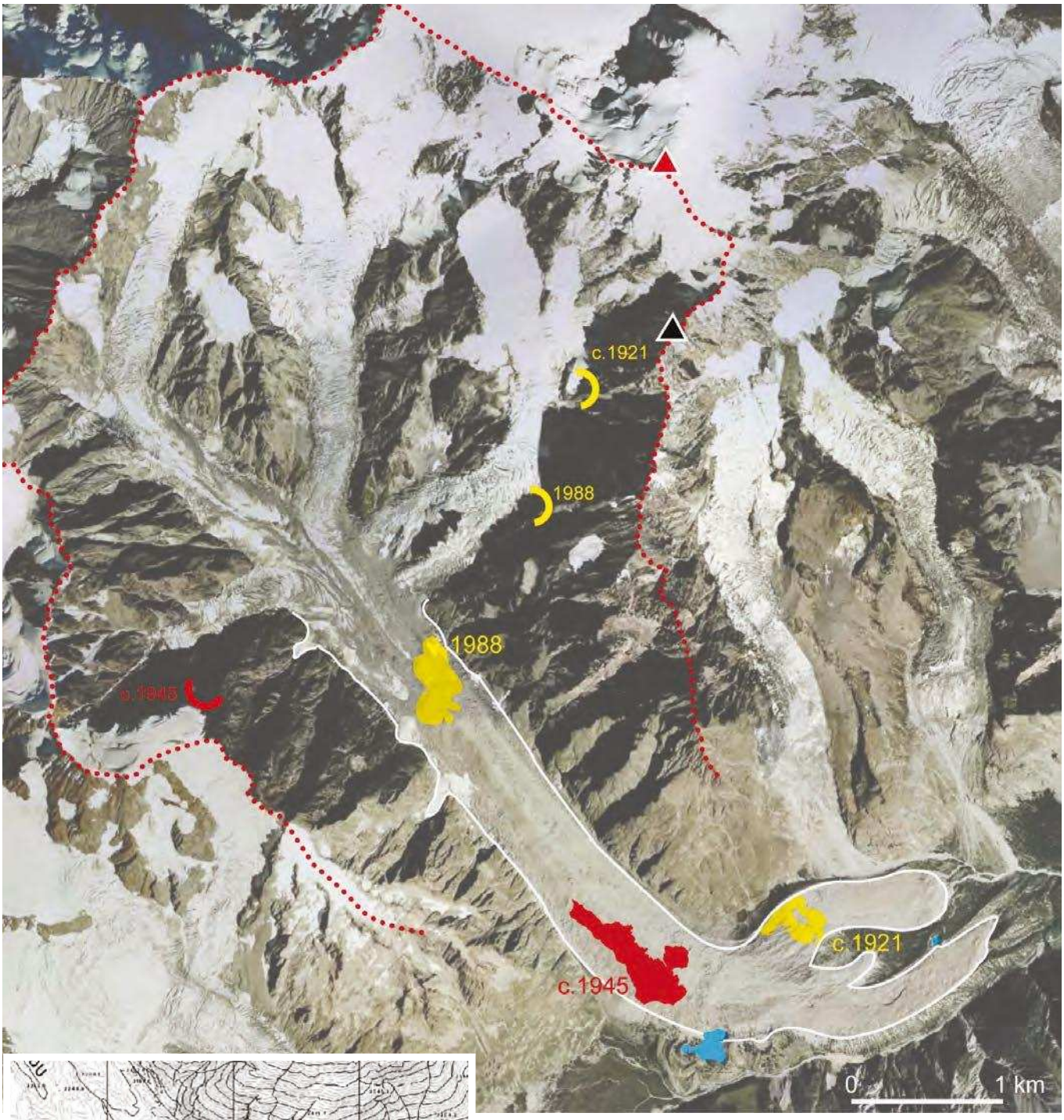
6- Interpretative map of the debris cover and slopes (from Hyperspectral MIVIS images) (Zamparutti, 2010)

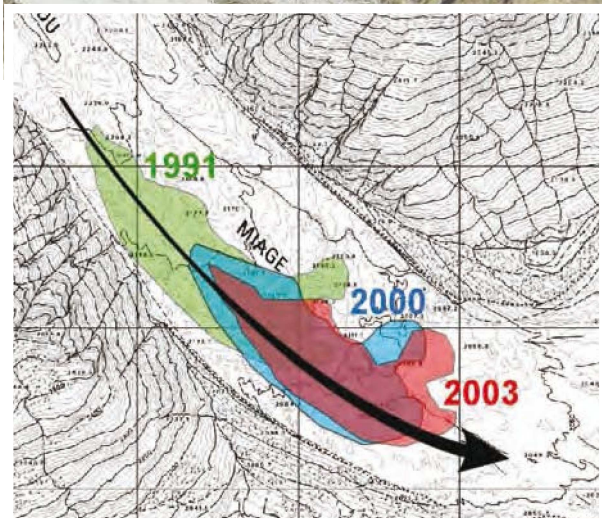


7- Debris thickness map of the Glacier du Miage supraglacial debris cover (Casati, 1998).



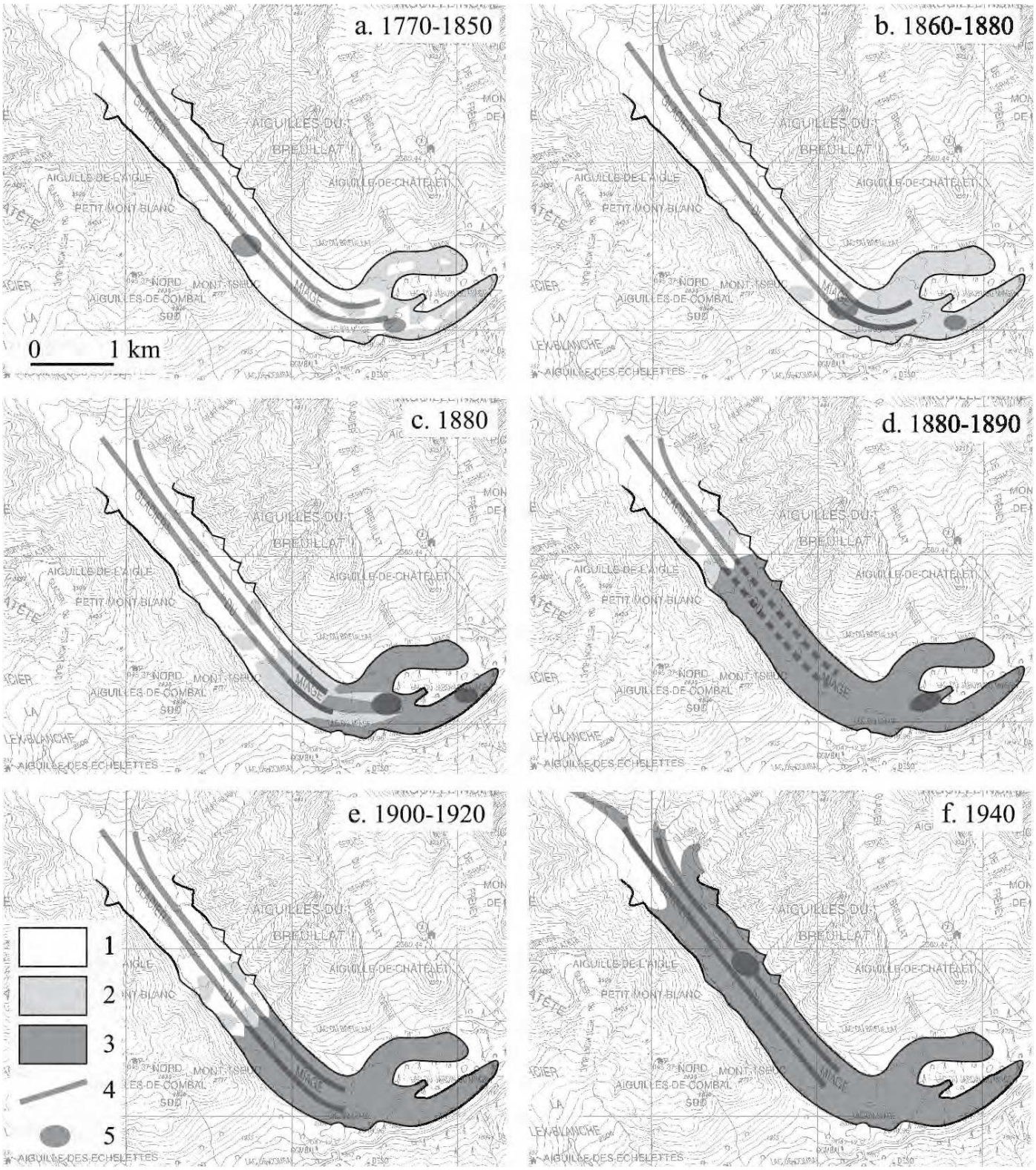
8- Map of the Glacier du Miage supraglacial debris cover in 1997 (Deline, 2002). Morpholithological units are determined on the basis of the lithology, roundness, shape and size of the debris, and the unit pattern.



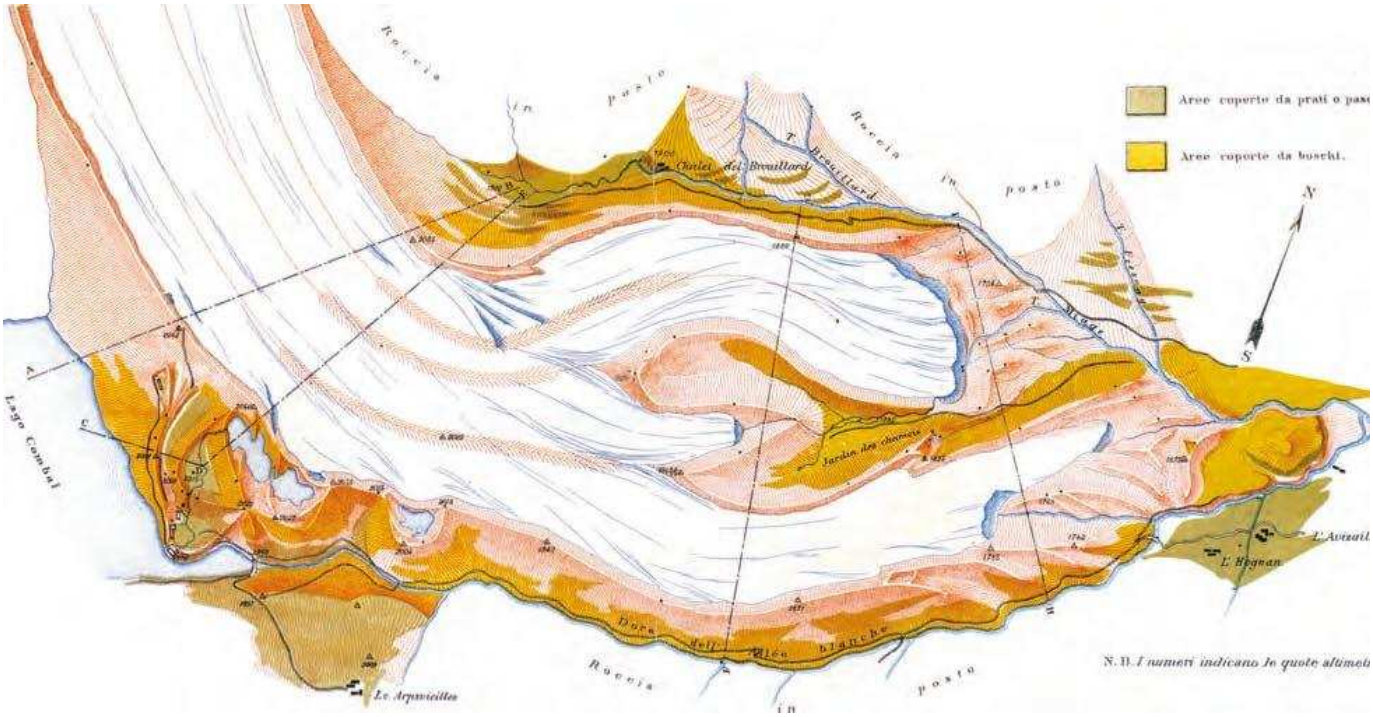


9- Locations of scars and deposits of 20th Century rock avalanches on the Glacier du Miage (Deline, 2009). Red dotted line: limits of the Miage glacial basin; red triangle: Mont Blanc (4808 m a.s.l.); grey triangle: Pointe Amédée (4460 m a.s.l.). Rock-avalanche deposits are transported on the surface of the glacier. Ice-contact Lake Miage lies at south within a morainic amphitheatre associated with the large southern lateral moraine (Orthophoto: 2000).

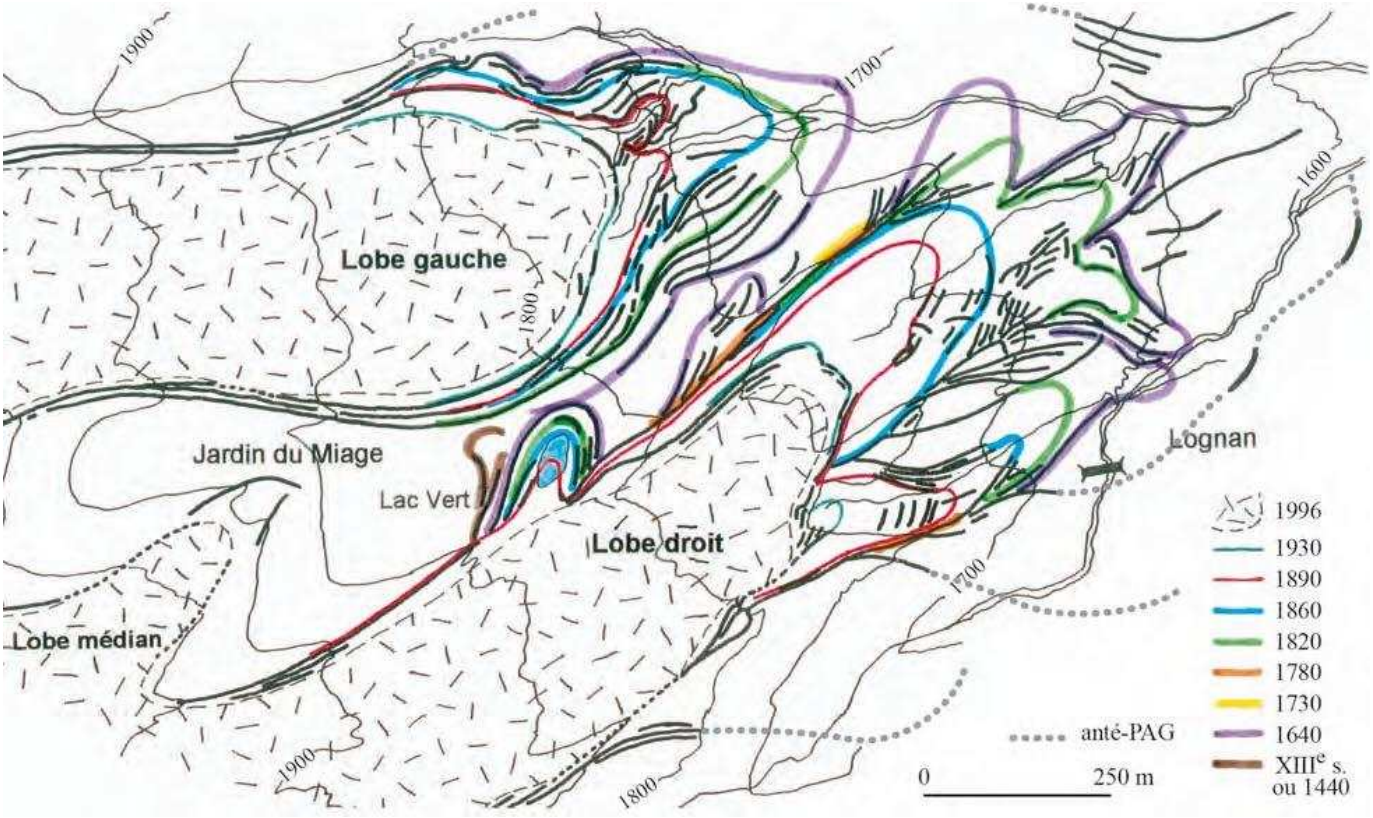
Insert: displacement of the 1940s rock avalanche deposit between 1991 and 2003. (Zamparutti, 2010)



10- The six main stages of the Miage glacier debris cover expansion (1770-1940). 1 : 'clean' ice ; 2 : discontinuous debris cover ; 3 : continuous debris cover ; 4 : medial moraine ; 5 : local rock avalanche deposit (Deline, 2005).



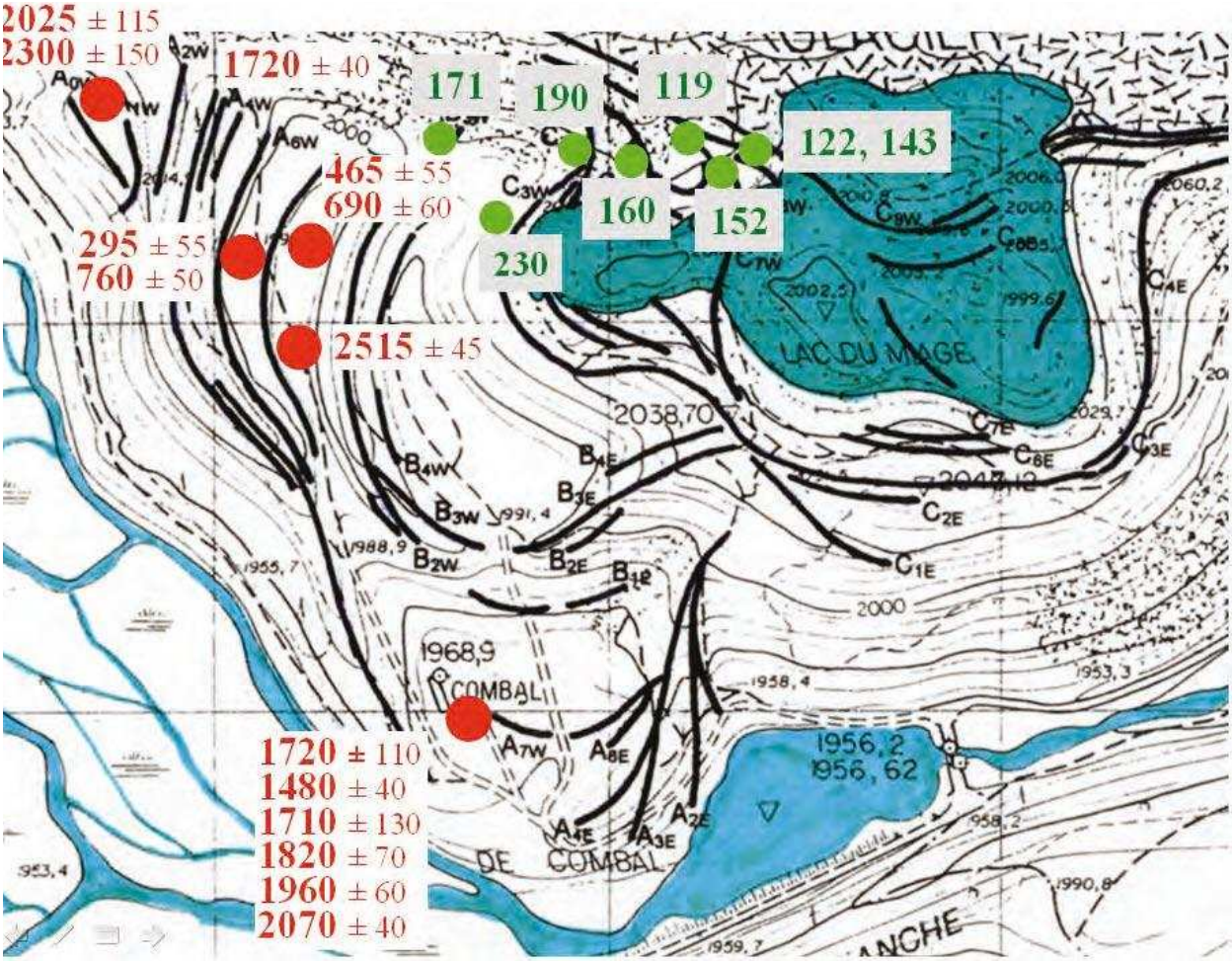
11- Map of the Glacier du Miage by Baretti (1880). Supraglacial moraines are not fully replaced by a continuous debris cover at this time.



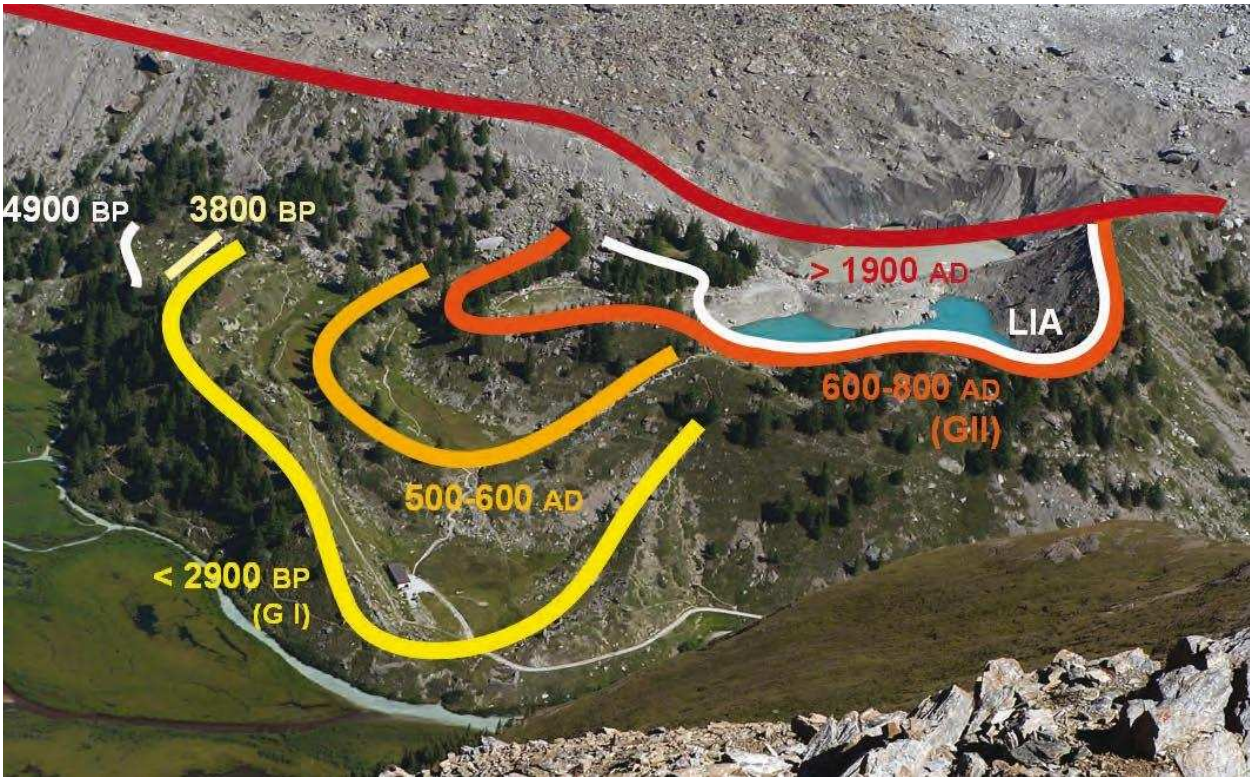
12- Reconstruction of the positions of the front of the two lobes of the Glacier du Miage during the LIA and after its termination (Deline, 1999).

13- View from the Mont Fortin of the Miage Morainic Amphitheatre (MMA) with its ice-contact lake.

14- Historical pictures of the Miage Lake.

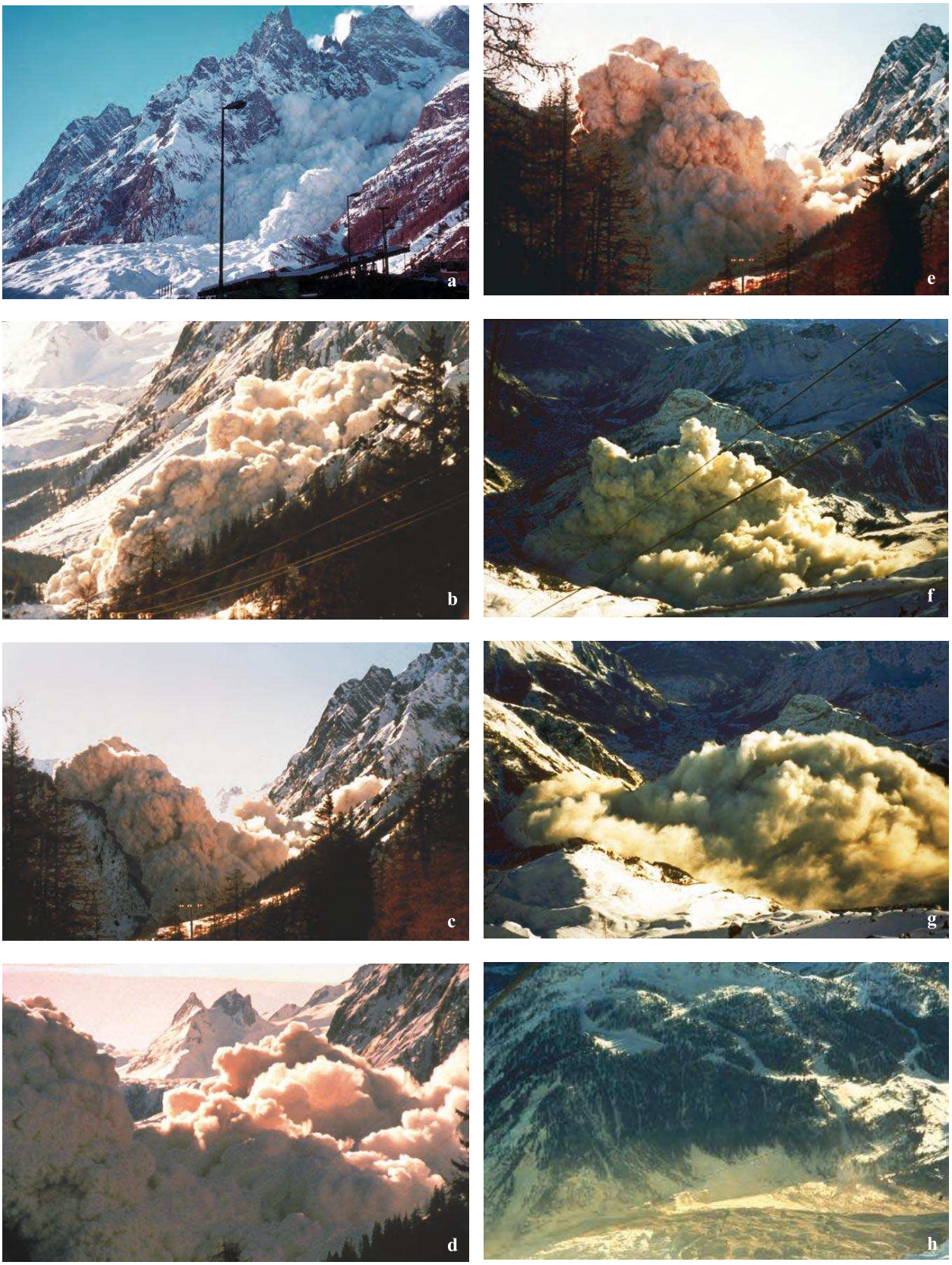


15- Map of the Miage Morainic Amphitheatre (MMA) with radiocarbon (red, conventional age) and dendrochronological (green, on living Larches) ages.

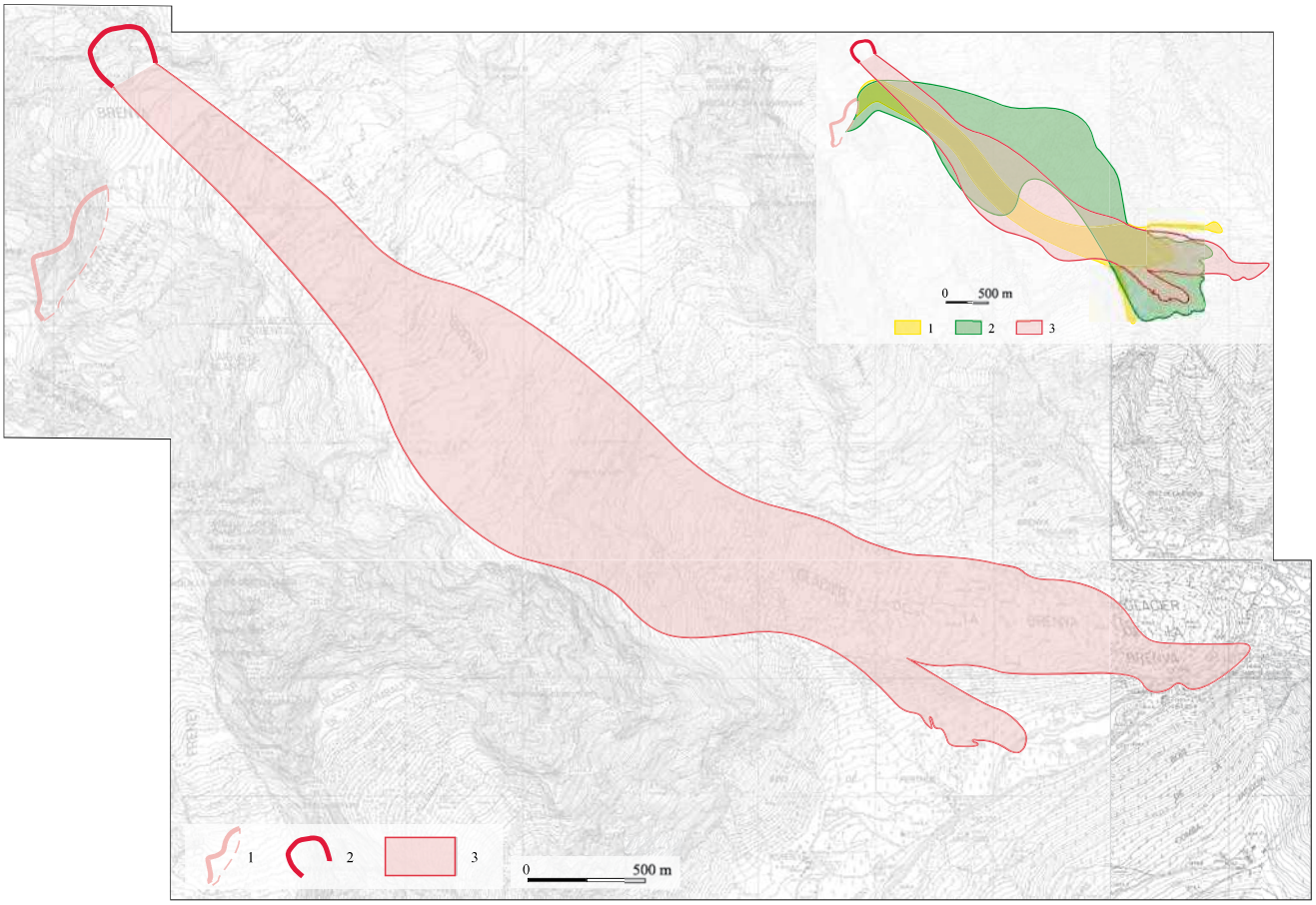


16- Chronology of the reconstructed formation of the MMA, obtained with radiocarbon and surface exposure dating.

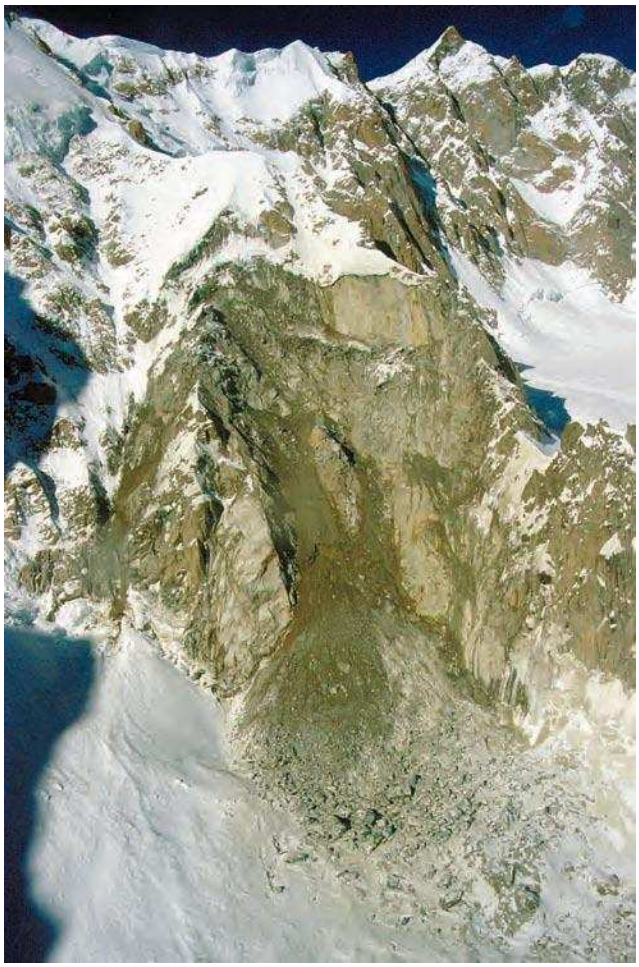
17- Glacier de la Brenva, with scars (thick lines) and tracks (thin lines) of the rock avalanches of 19 November 1920 (yellow lines) and 18 January 1997 (red lines). The Mont Blanc summit stands at 4808 m a.s.l. The exit of the Mont Blanc Tunnel is visible downvalley of the glacier at 1370 m. Dashed lines: areas hidden by rock spurs (Deline, 2009).



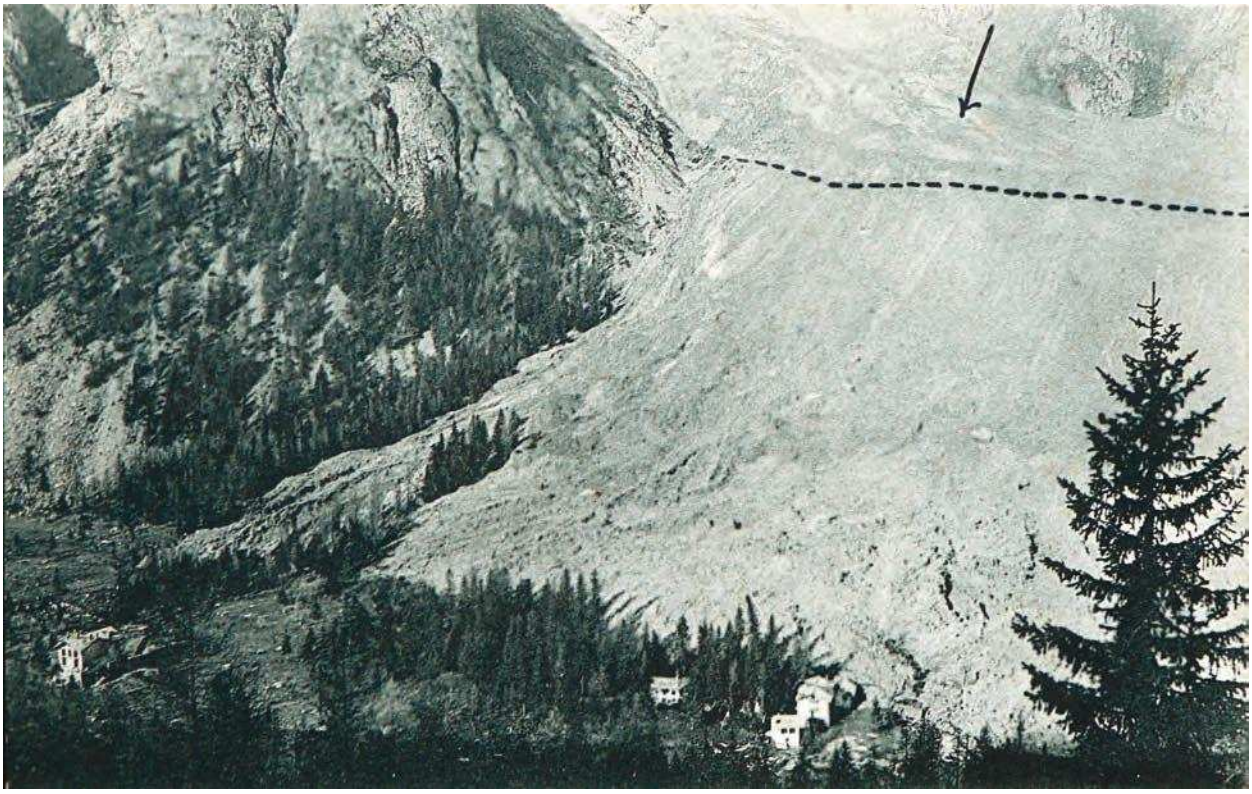
18- Successive stages of the snow avalanche triggered by the 1997 rock avalanche onto the Glacier de la Brenva (M. Pennard; Società Funivie Courmayeur)



19- Map of the path of the 1997 rock avalanche onto the Glacier de la Brenva. Insert: 1920 rock avalanche paths (Deline, 2002).



20- Scar of the 1997 rock avalanche on Eperon de la Brenva. The scar is 250 m-wide, 300 m-high and tens of metres deep (photo by G. Mortara, 02/1997).

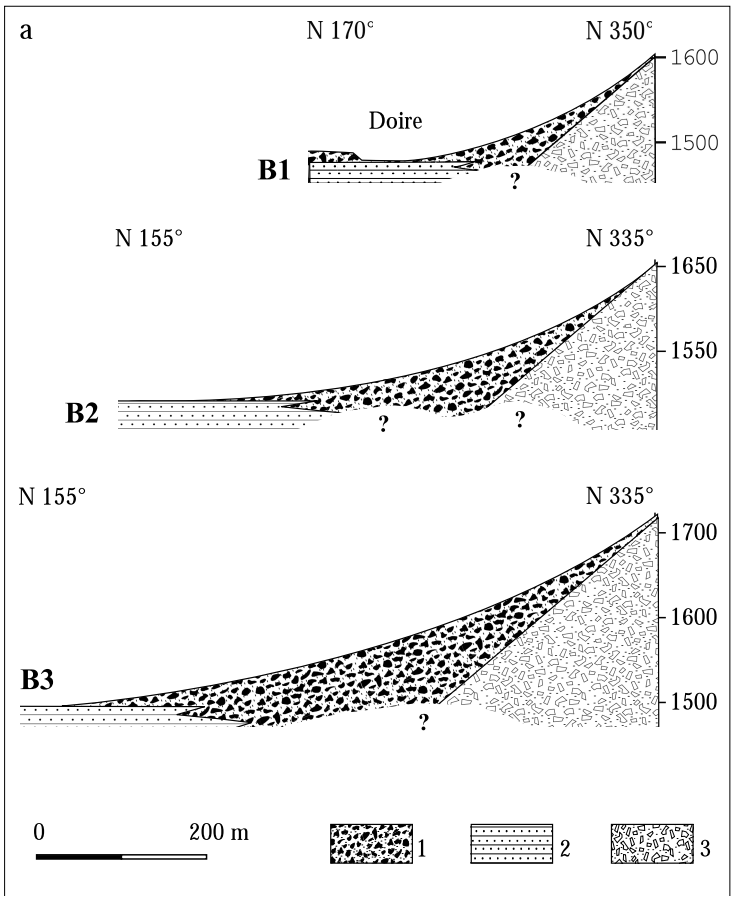


21- Photograph of the mixed (rock-ice-snow) deposit of the 1920 rock avalanche onto the distal flank of the right lateral moraine of the Glacier de la Brenva (J. Brocherel). The dashed line shows the moraine crest.

22- Etching *Vue du Glacier de la Brenva* by Töpffer, after a July 1767 Jallabert's drawning (Saussure, 1786). On this artwork, (i) disparition of the right lateral moraine under ice ; (ii) coalescent outflanking lobes ; (iii) northwards surface slope ; (iv) transversal groove in the frontal area, drained by the Doire valley river ; (v) surficial distribution of rock debris, are elements which suggest a mixed (rock and ice) rock avalanche deposit on the glacier rather than a glacier surge

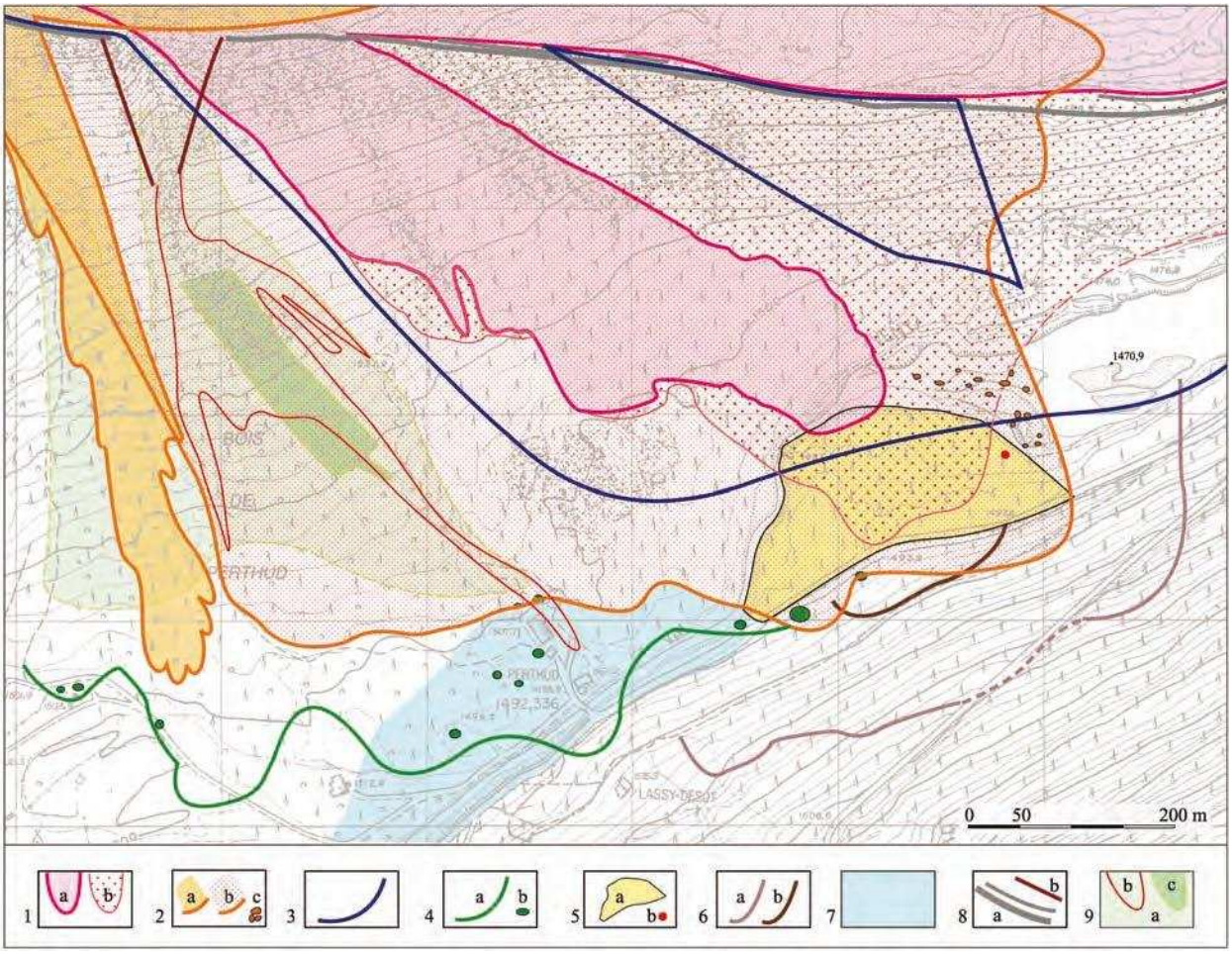
23- Lithography *Glacier of La Brenva, shewing the structure of ice*, by L. Haghe after a drawning by J.D. Forbes (Forbes, 1843)

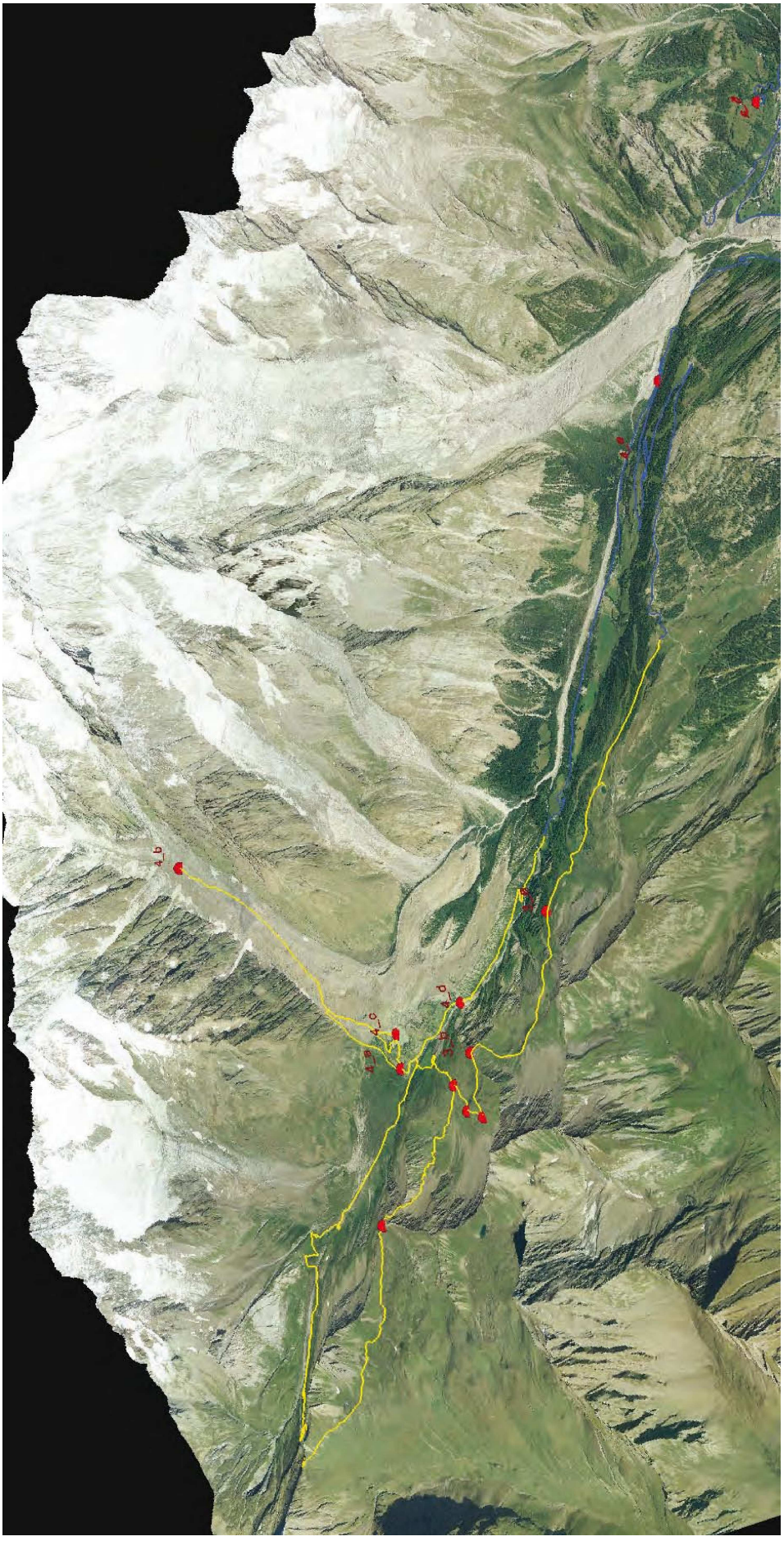
24- Postcards of the Glacier de la Brenva in the first decades of the 20th century



25- Brenva right-lateral moraine cross sections. 1: basal overthickness deposit; 2: fluvioglacial deposit; 3: lateral moraine (Deline, 2001).

26- Map of Brenva rock avalanche deposits during the Holocene. 1: 1997 deposit (a: continuous blocky deposit; b: thin and discontinuous deposit); 2: 1920 deposit (a: 14/11 ; b: 19/11 ; c: boulders); 3: 1767 deposit; 4: Saint-Jean-de-Perthud deposit (onset of LIA); 5: 1493.8 deposit (a: dépôt; b: 3-m-deep excavation); 6: Bois de la Comba Jacquin deposits (a: maximal extension; b: dense deposit of boulders); 7: temporary lake (19-22/11/1920); 8a: moraine crest; 8b: morainic breach (1928); 9: glacial outburst flood deposits (a: surveyed area ; b : limit of 1928 deposit ; c : 1975-1993 debris flow extension) (Deline, 2001).

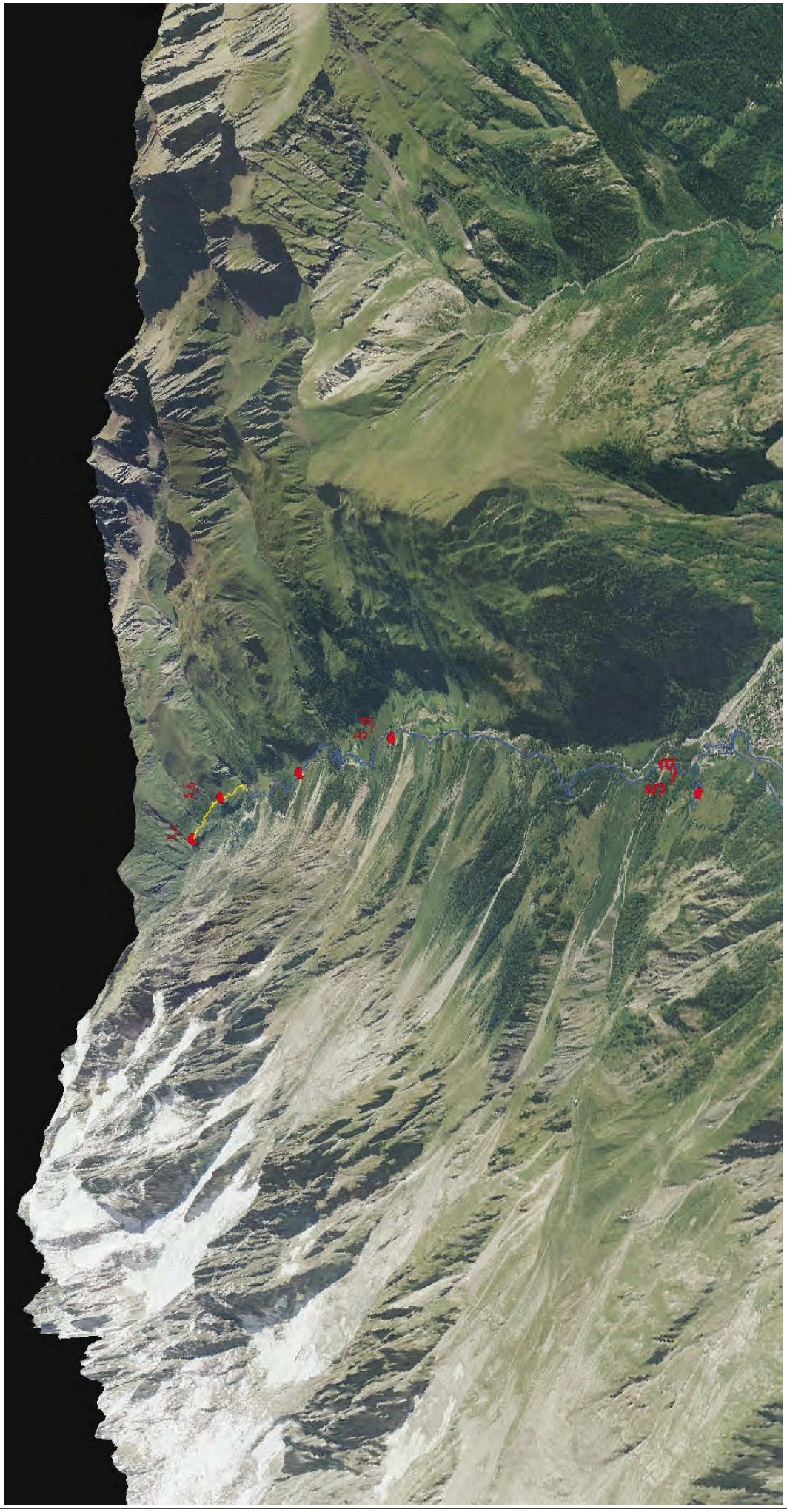




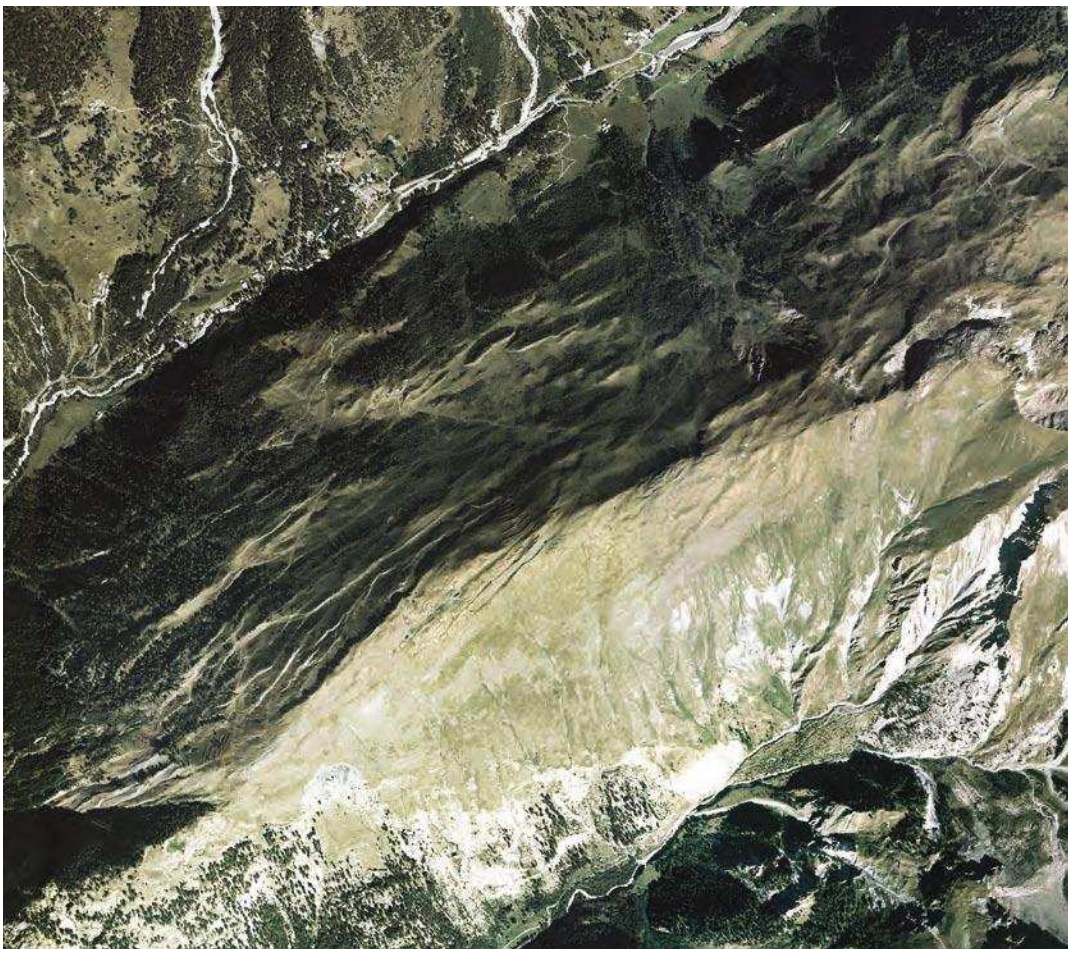
27- 2.5 Ortophotographic model of the Val Veny with the route of the field trip IAG-P6B, fourth day

Val Ferret

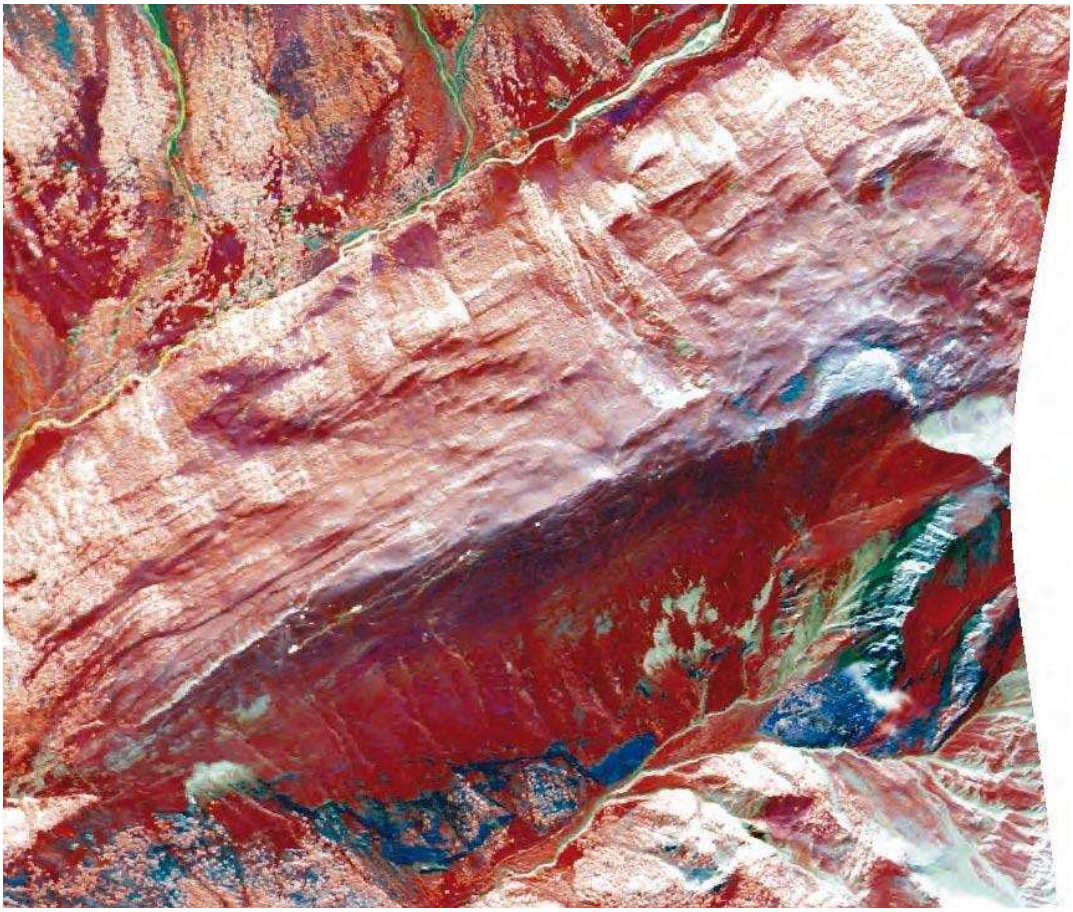
A view of the SE side of the Mont Blanc massif in the Val ferret (FMs, 09/2004)



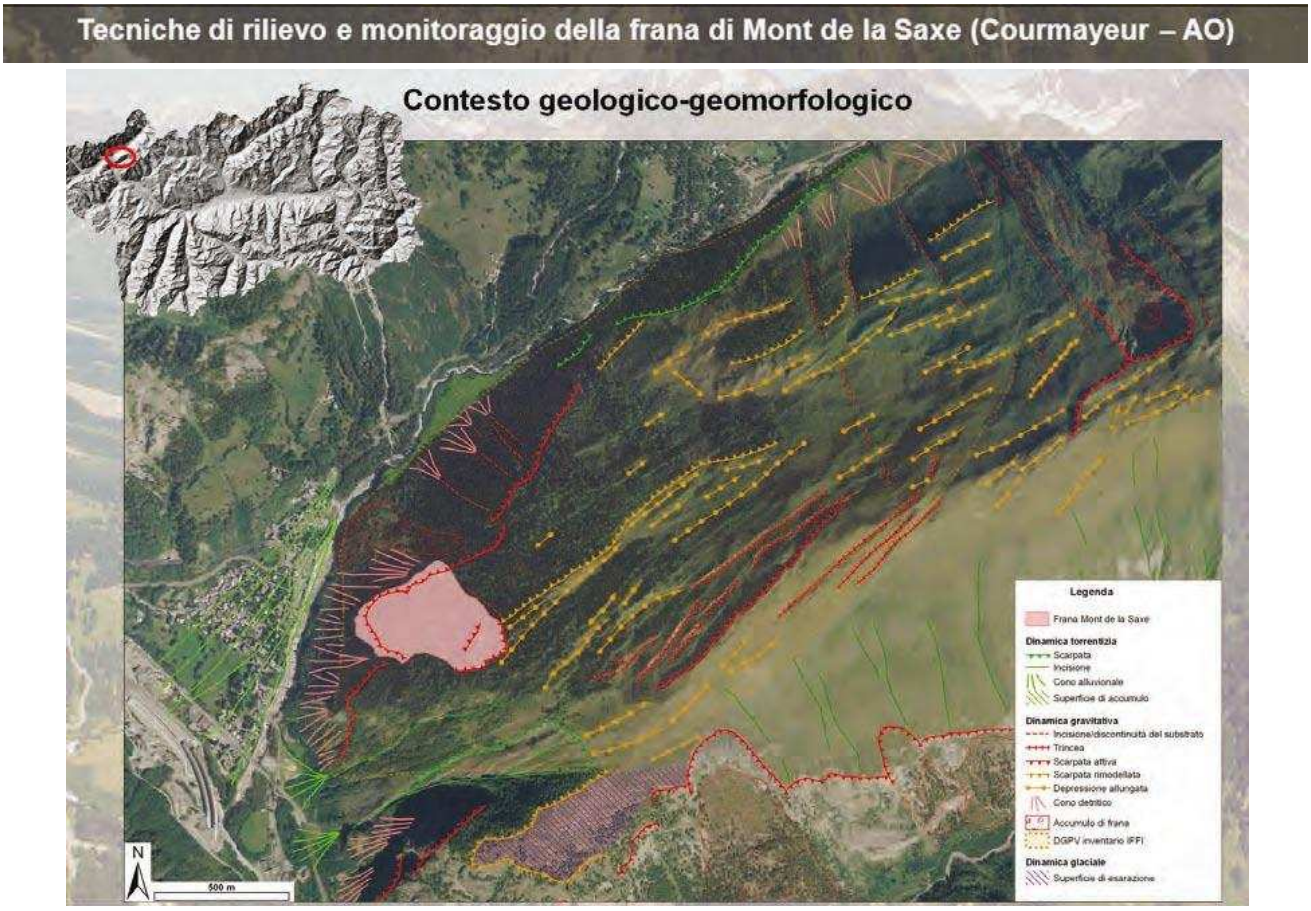
1- 2.5 Ortophotographic model of the Val Ferret with the route of the field trip IAG-P6B, 5th day



2- Orthophoto (scale 1:10.000) of the Mont de la Saxe ridge (Giardino et al., 2004).

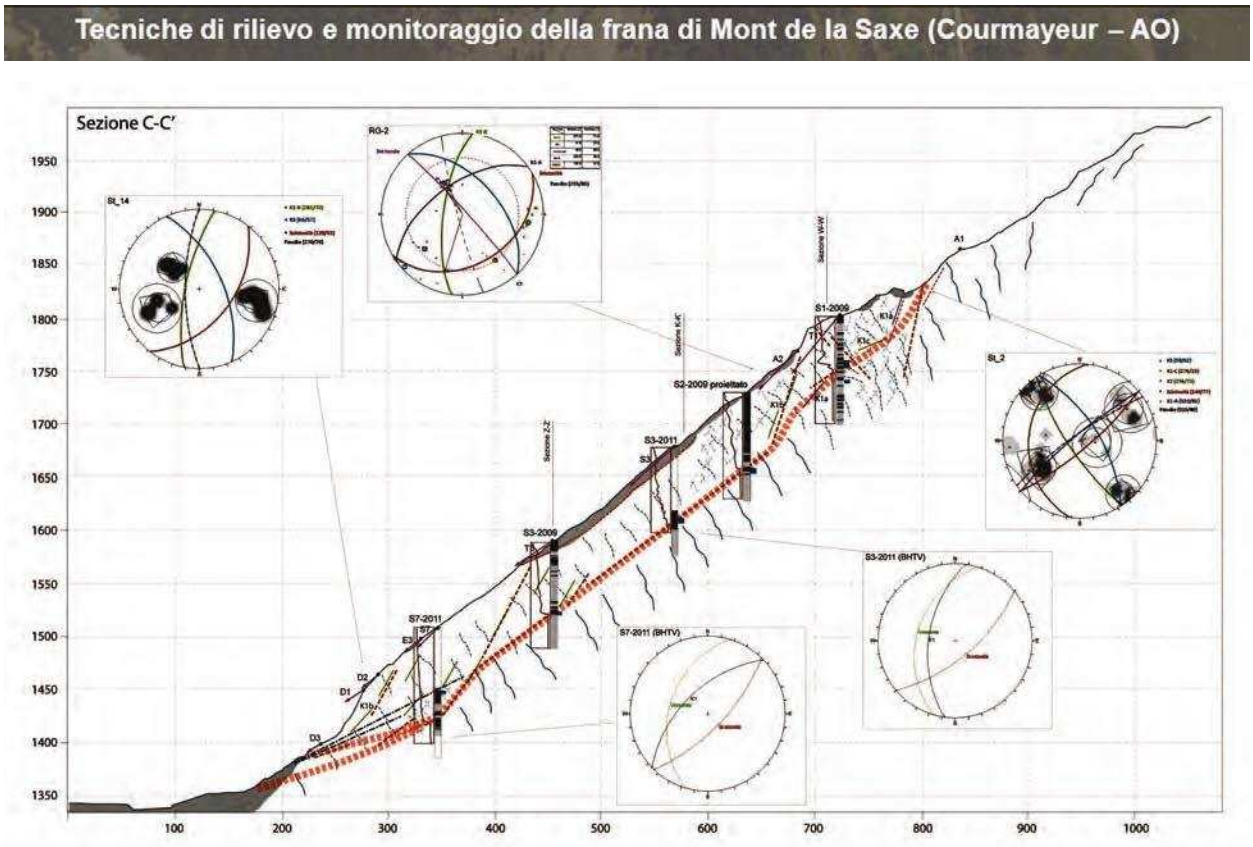


3- False color (R:b27 G:b22 B:b18) negative near infrared image of Mont de la Saxe ridge (Giardino et al., 2004)

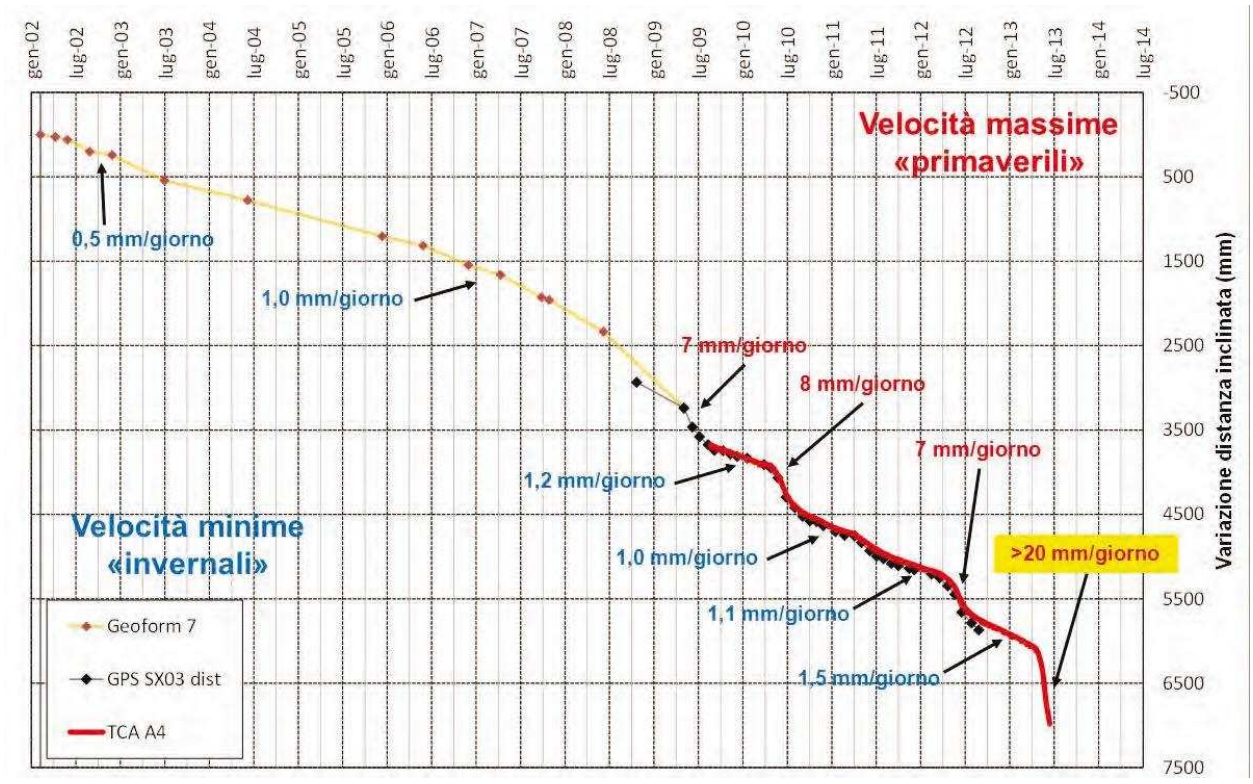


4- General geomorphological setting of the Southern side of the Val Ferret, including Mont de la Saxe landslide and the deep-seated gravitational slope deformations affecting the all watershead ridge (IMAGEO, 2009).

5- Rock block flexural toppling phenomena at Mont de la Saxe lateral scarp; deformational mechanism is associated to rotational sliding (IMAGEO, 2009).



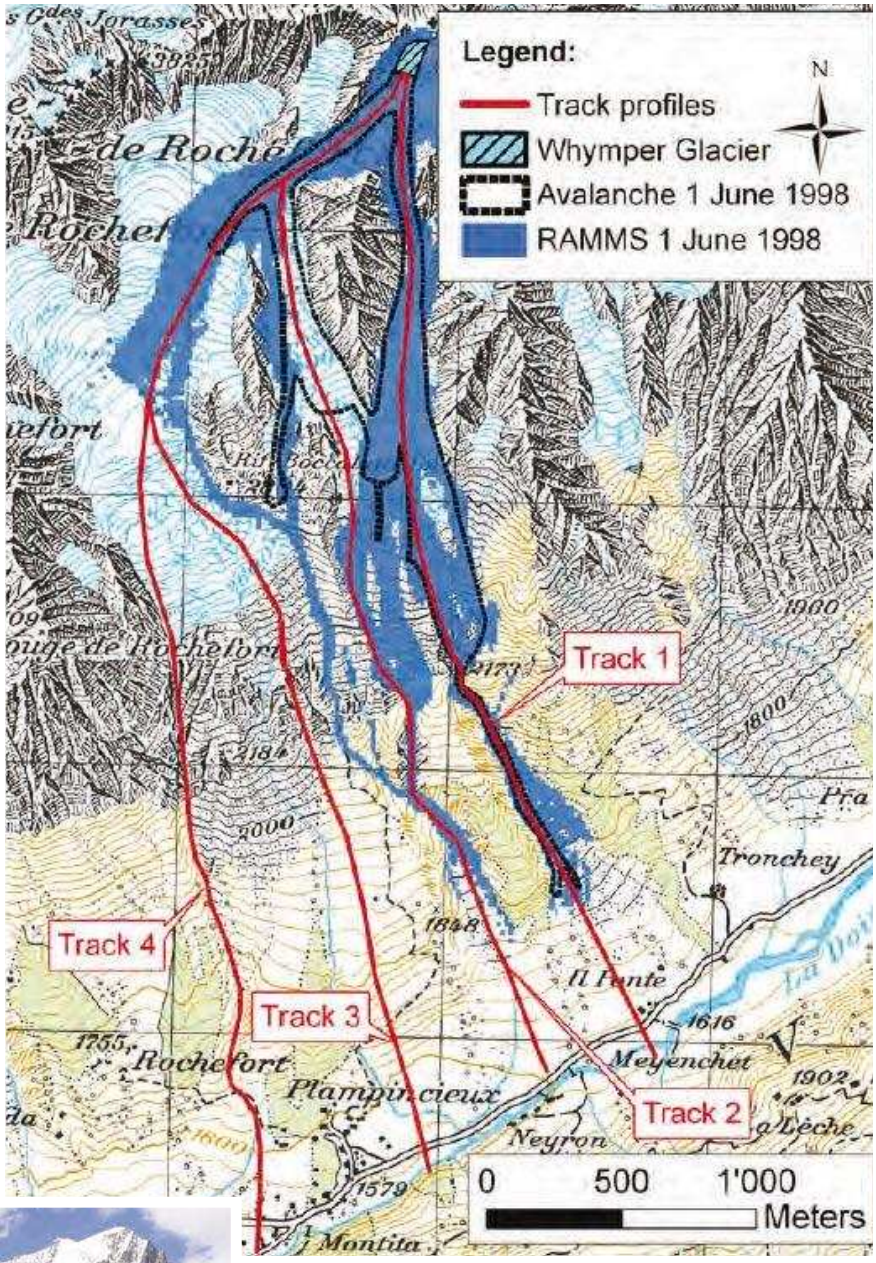
6- Longitudinal cross profile of the landslide, with instrumented drill holes and main structural sets outlined and geometrically represented on the stereographic Schmidt nets (lower emisphere) (IMAGEO, 2009).



7- Landslide cumulative velocity diagram at Mont de la Saxe, from different monitoring systems, since 2002 (IMAGEO, 2009).

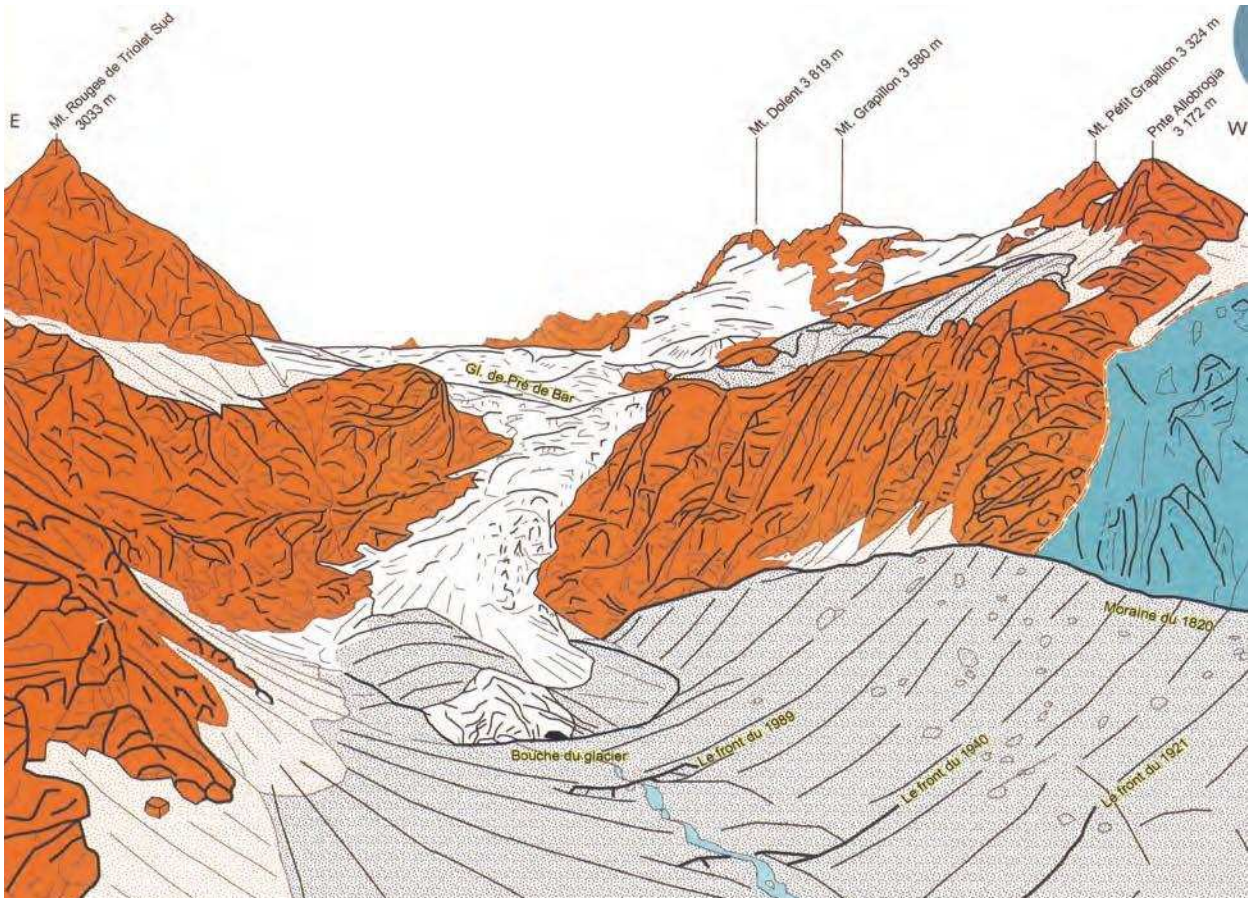
8- Photographs of cold-based hanging Glacier Whymper before and after the ice avalanche of May 1998 (FMs).

9- Glacier Whymper (South side of the Grandes Jorasses), and permanent dGPS infrastructure at its surface to monitor its displacement (FMs). :

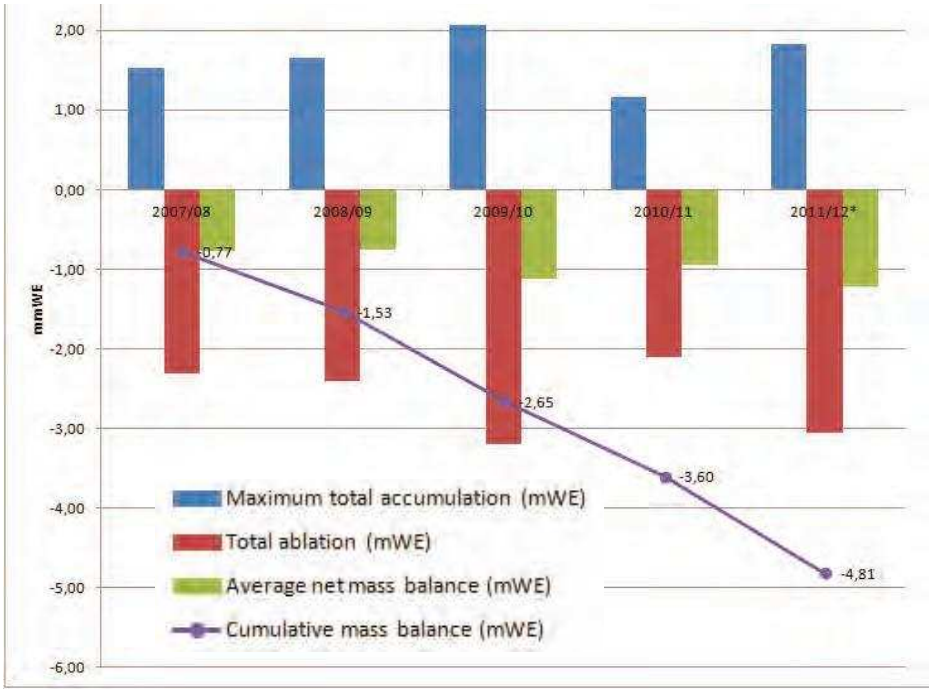


10- Observed extension of the 1 June 1998 ice avalanche from the Whymper Glacier with possible tracks and simulation of this ice avalanche with the 2-dimensional avalanche calculation model RAMMS (Margreth et al. 2011).

11- Track of the 2002 rock fall from Tour des Grandes Jorasses (Deline, 2009). The summit (Pointe Walker) stands at 4208 m a.s.l.; the Val Ferret floor is 1580–1780 m. Dashed lines: path hidden by gully. Dots: source area and toe of the deposit of the September 2007 rock fall.

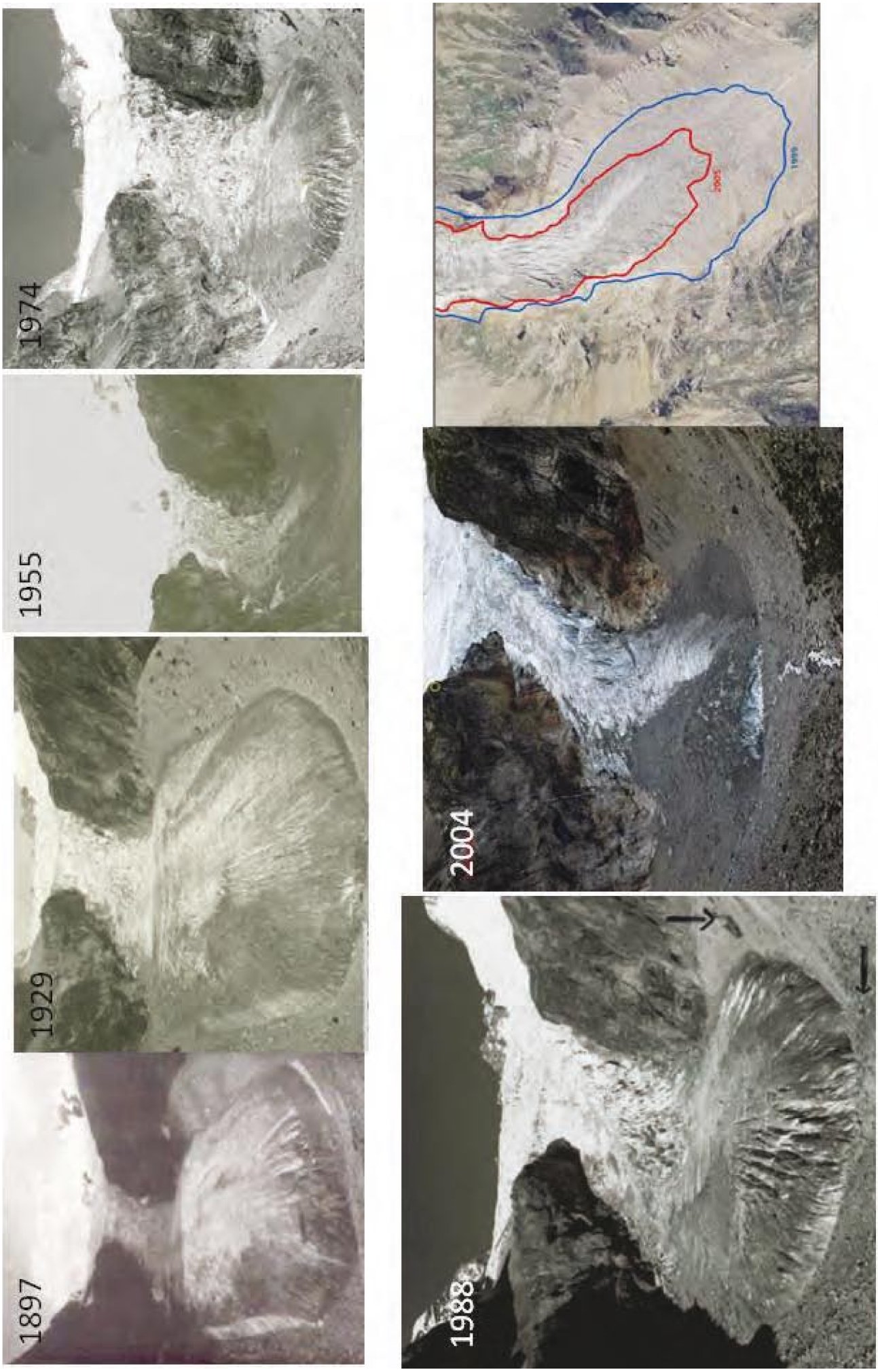


12- Geological panorama of the Pré de Bar Glacier basin (Amelot and Bolognini, 2008)



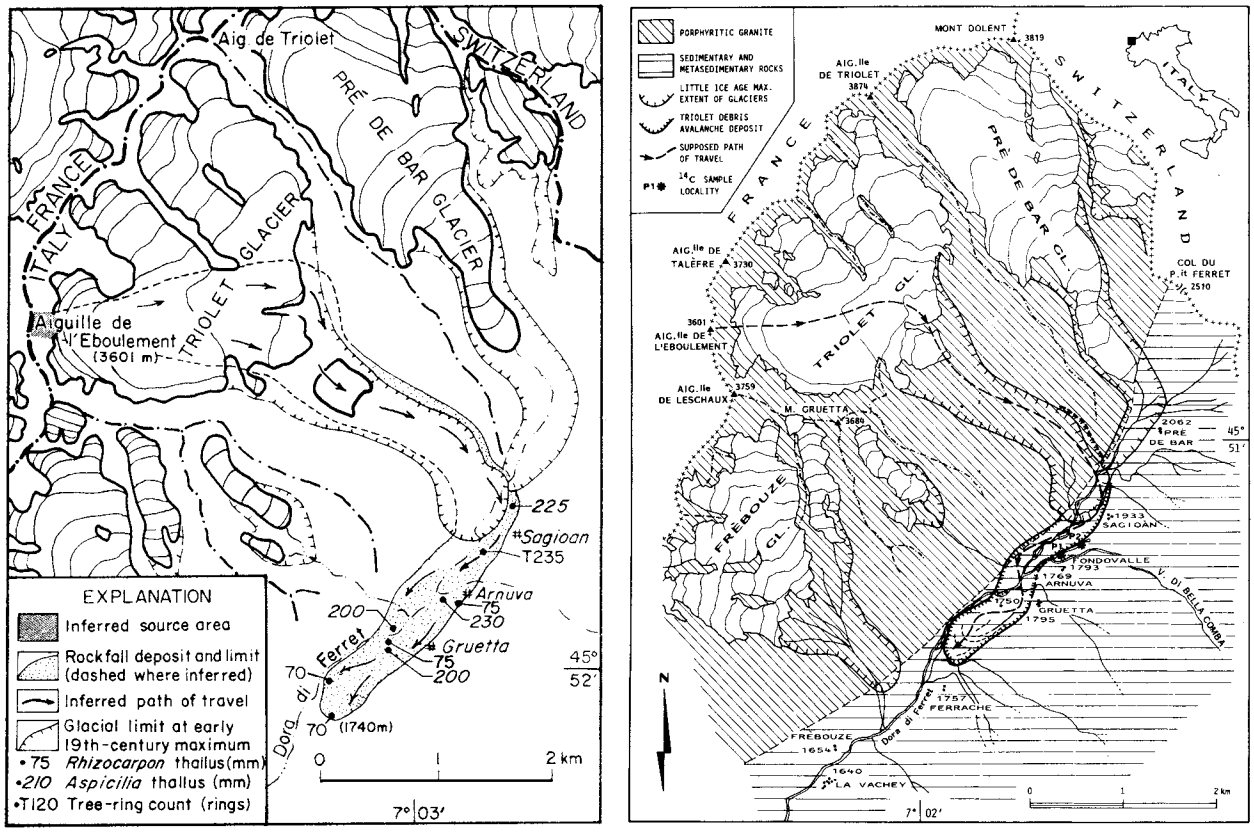
13- Pré de Bar Glacier mass balance since 2007/2008

14- The Pré-de-Bard as seen from the Alp of Pré-de-Bard by d'Ostervald around 1821-22 ("Glacier du Mont-Dolent"; signed down left "J.F.d'Ostervald delt.", marked down right "Salathé sculpt."; aquatint; 14.5 x 21.0 cm; Raoul-Rochette, 1826) and in July 2009 (photograph by P. Imhof) (Imhof, 2010).

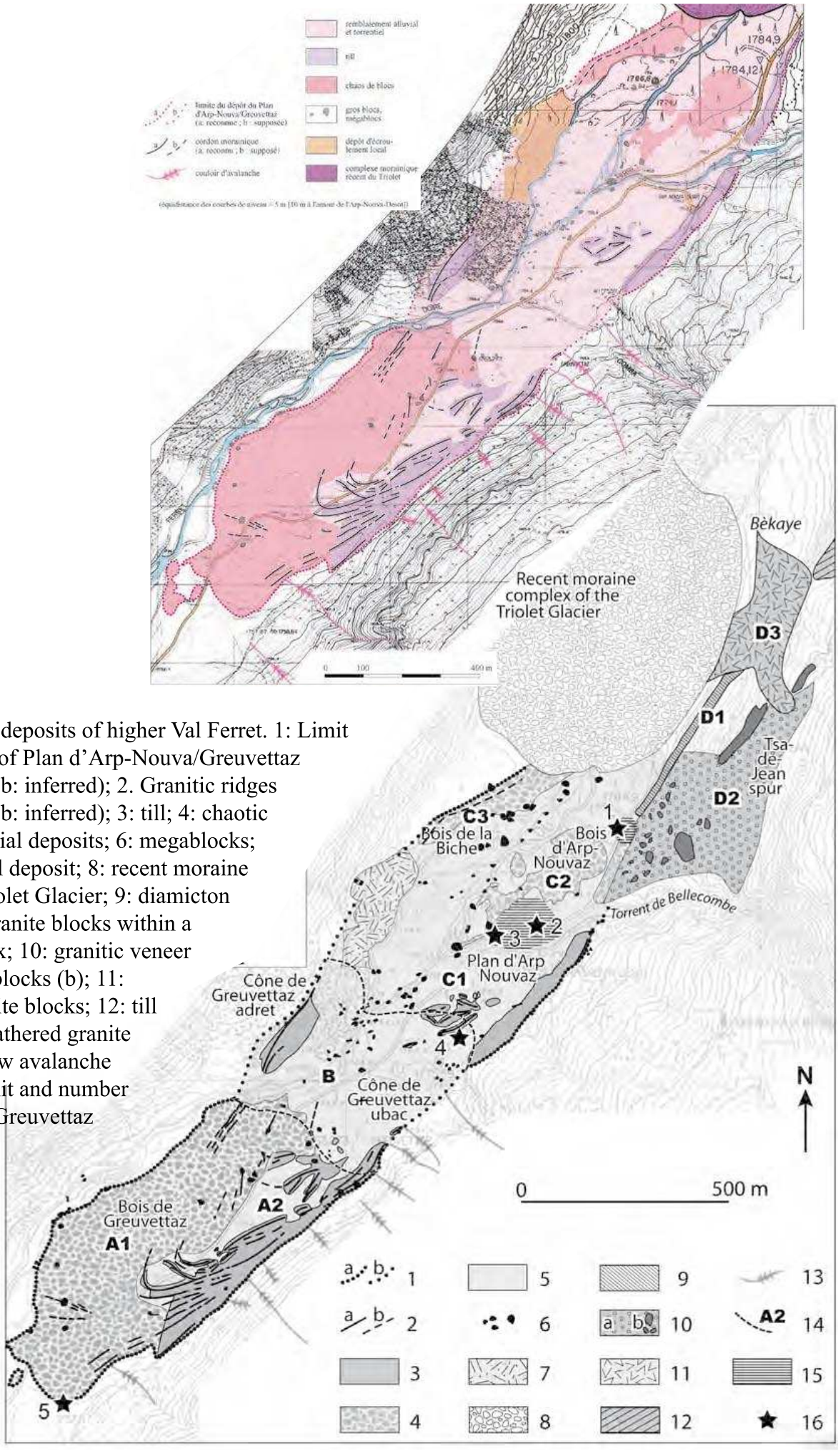


15- Historical pictures of the Pré de Bar Glacier

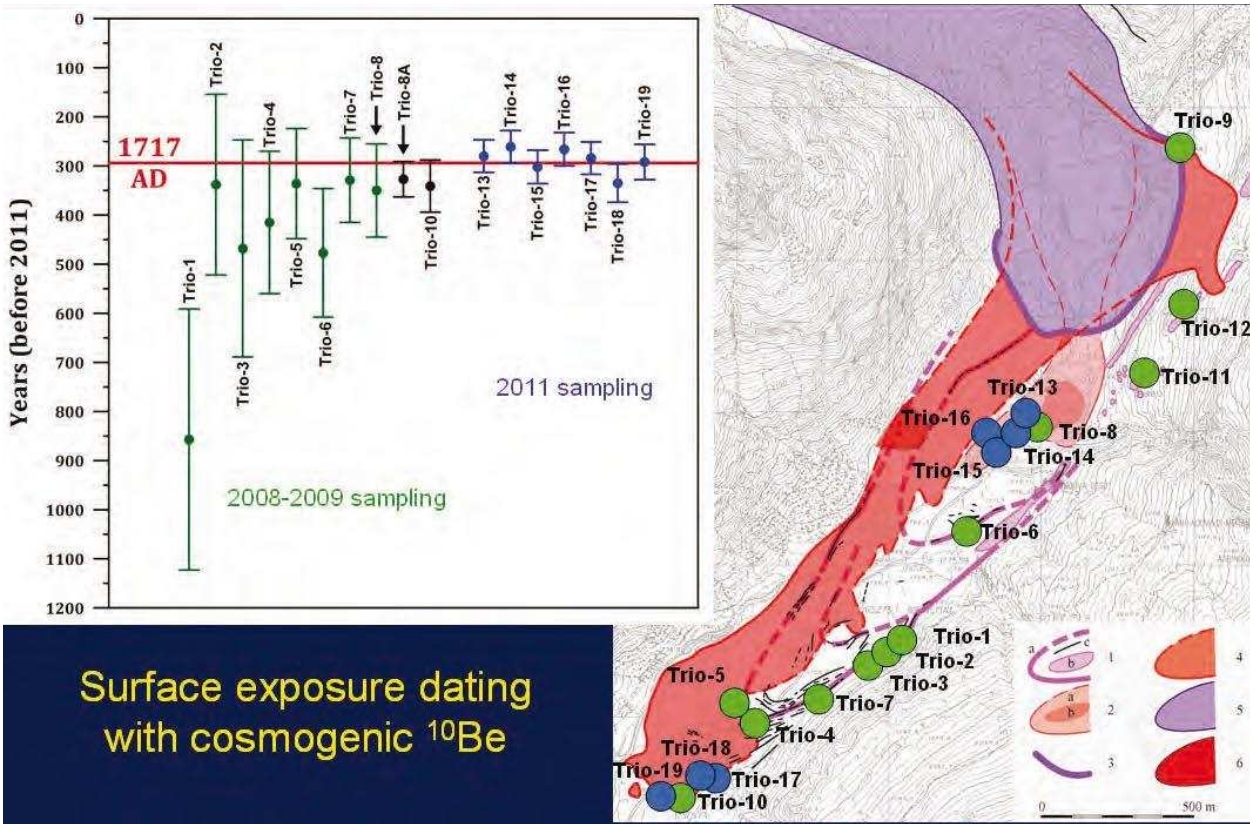
16- View upvalley of Glacier de Triolet, upper Val Ferret (Deline, 2009). Yellow line: limit of the granitic deposits (dashed line: hidden limit). Purple ribbon: limit of the recent morainic complex of Glacier de Triolet. Distance from the morainic complex to the toe of deposit is 2 km.



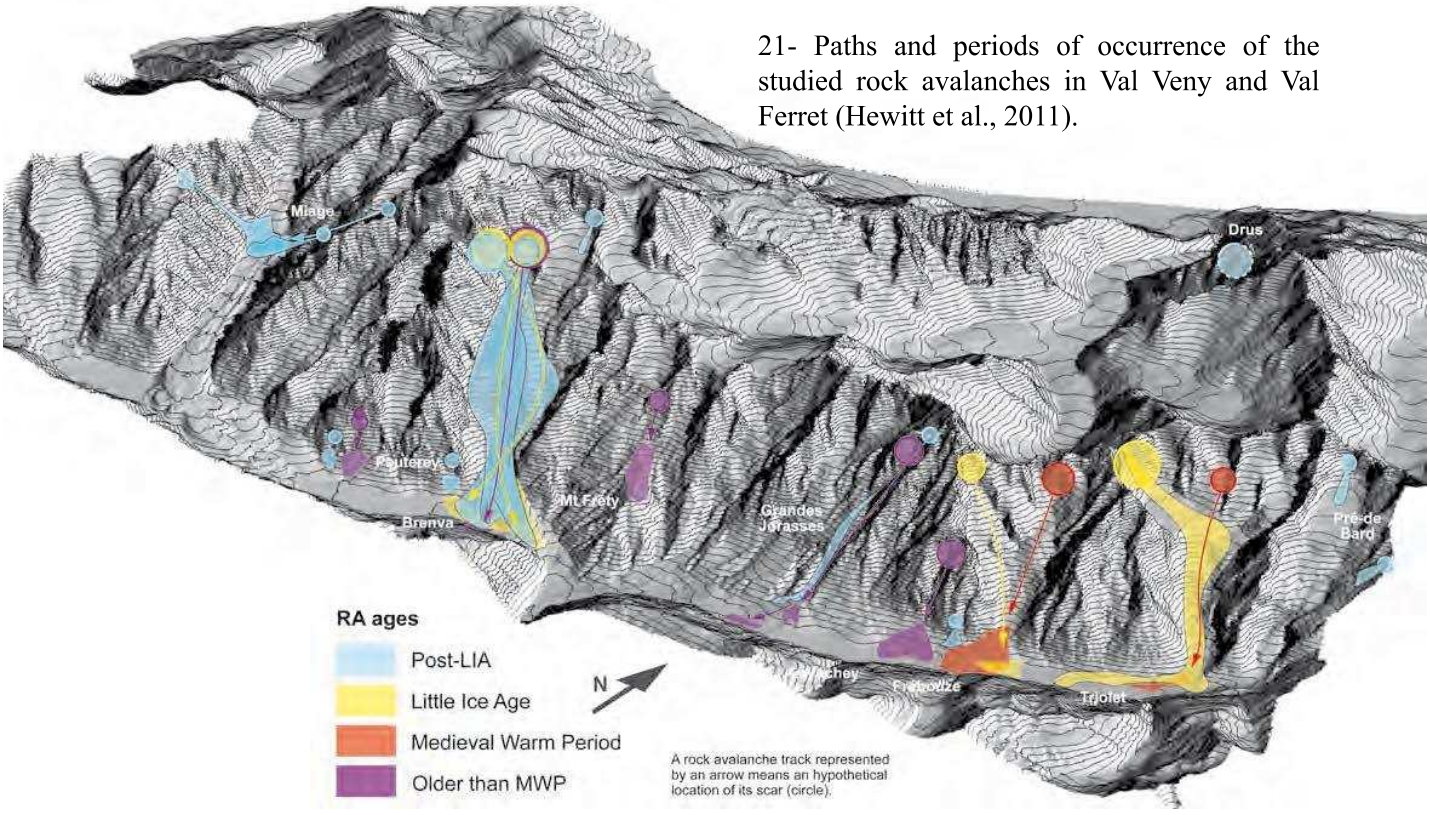
17- Maps of 1717 rock avalanche track (Porter & Orombelli, 1980, 1988)



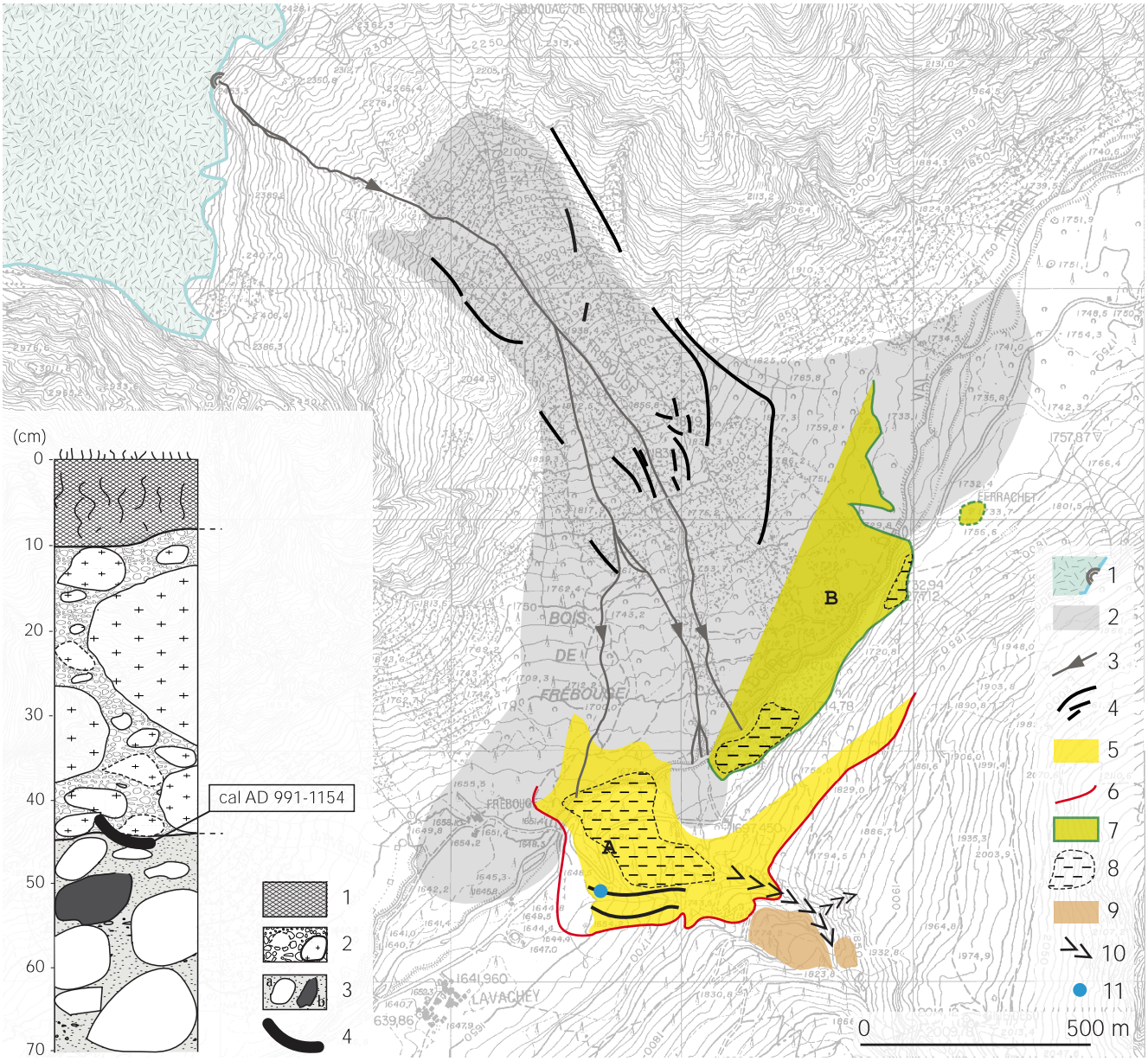
19- Map of the deposits of higher Val Ferret. 1: Limit of the deposits of Plan d'Arp-Nouva/Greuvettaz (a: recognized; b: inferred); 2. Granitic ridges (a: recognized; b: inferred); 3: till; 4: chaotic blocks; 5: alluvial deposits; 6: megablocks; 7: local rockfall deposit; 8: recent moraine complex of Triolet Glacier; 9: diamicton consisting of granite blocks within a schistose matrix; 10: granitic veneer (a), with megablocks (b); 11: deposit of granite blocks; 12: till comprising weathered granite blocks; 13: snow avalanche couloir; 14: limit and number of Arp-Nouva/Greuvettaz and Tsa-de-Jean sectors; 15: peat bog; 16: location of radiocarbon dates (Deline & Kirkbride, 2009).



20- Deposits of the Glacier de Triolet area (Deline, 2009). 1: Lateglacial morainic complex (a: limit; b: till veneer; c: moraine crest). 2: Holocene rock-avalanche deposit older than AD 1000 (a: limit; b: chaotic boulder accumulation). 3: outermost moraine postdating the Holocene rock avalanche. 4: rock-avalanche deposit of AD 1717. 5: 18th–20th Century morainic complex of Glacier de Triolet. 6: rock fall deposit after AD 1717 (topographic map: 1:10 000 with 10 m contour interval).



21- Paths and periods of occurrence of the studied rock avalanches in Val Veny and Val Ferret (Hewitt et al., 2011).



21- Rock avalanches in the Glacier de Frébouge area (Deline, 2009). 1: Glacier de Frébouge and its mouth. 2: Frébouge fan area. 3: proglacial torrent. 4: Little Ice Age moraines. 5: older rockavalanche deposit (deposit A). 6: outer limit of deposit A. 7: younger rock-avalanche deposit (deposit B). 8: most dense area of granite boulders. 9: Malatra earth-flow deposit. 10: Malatra gully. 11: Location of inset cross-section. Inset: cross-section at the surface of a moraine of Lateglacial Val Ferret Glacier. 1. A1 horizon. 2: Diamicton of subangular granite boulders in an abundant matrix (dashed outline: weathered boulder). 3: Diamicton of non-granite boulders (a: calcareous schist; b: travertine). 4: Radiocarbon-dated wood (topographic map: 1:10,000 with 10 m contour interv

Bibliographie

Amelot, F., Bolognini, D. (Eds.), 2008. Les plus beaux paysages du Pays du Mont Blanc. MRSN Saint-Pierre/ CNM Sallanches, 516p.

Bacenetti, M., 2010. A structural geomorphological characterisation of Veny valley (Courmayeur, Aosta) by using an integrated field-based and technical geomatics approach. MSc thesis, Università di Torino.

Baretti, M., 1880. Il ghiacciaio del Miage. Versante italiano del gruppo del Monte Bianco (Alpi Pennine). *Memoria della Reale* Accademia delle Scienze di Torino, 2 : 3-36.

Casati, D., 1998. Studio della dinamica di un debris-covered glacier : il Ghiacciaio del Miage. MSc thesis, Universitá di Milano.

Coutterand, S., 2010. Étude géomorphologique des flux glaciaires dans les Alpes nord-occidentales au Pléistocène récent. Du maximum de la dernière glaciation aux premières étapes de la déglaciation. PhD thesis, Université de Savoie.

Deline, P., 1999. Les variations holocènes récentes du glacier du Miage (Val Veny, Val d'Aoste). *Quaternaire* 10 (1), 5-13.

Deline, P., 2001. Recent Brenva rock avalanches (Valley of Aosta) : new chapter in an old story ? *Geografia Fisica e Dinamica Quaternaria*, Supplemento 5, 55-63.

Deline, P., 2002. Etude géomorphologique des interactions entre écroulements rocheux et glaciers dans la haute montagne alpine : le versant sud-est du massif du Mont Blanc (Vallée d'Aoste, Italie). PhD thesis, Université de Savoie.

Deline, P., 2005. Change in surface debris cover on Mont Blanc massif glaciers after the 'Little Ice Age' termination. *The Holocene,* 15 (2), 302-309, doi: 10.1191/0959683605hl809rr.

Deline, P., Kirkbride, M.P., 2009. Rock avalanches on a glacier and morainic complex in Haut Val Ferret (Mont Blanc massif, Italy). *Geomorphology*, 103: 80-92, doi:10.1016/j.geomorph.2007.10.020.

Deline, P., 2009. Interactions between rock avalanches and glaciers in the Mont Blanc massif during the late Holocene. *Quaternary Science Reviews*, 28 (11-12) : 1070-1083, doi: 10.1016/j.quascirev.2008.09.025.

Deline, P., Gardent, M., Magnin, F., Ravanel, L., 2012. The morphodynamics of the Mont Blanc massif in a changing cryosphere: a comprehensive review. *Geografiska Annaler*: Series A, Physical Geography, 94: 265–283. doi:10.1111/j.1468-0459.2012.00467.x

Forbes, J.D., 1843. Travels through the Alps of Savoy and others parts of the Pennine chain. Black, Edinburgh, 460 p.

Gardent, M., 2013. Evolution des glaciers des Alpes françaises depuis la fin du Petit Âge Glaciaire. PhD thesis in progress, Université de Savoie.

Giardino, M., Borgogno Mondino, E., Perotti, L., 2004. MIVIS images classification for the geomorphological characterization of large slope instabilities in Aosta Valley (Italian NW-Alps). Proceedings of SPIE, 5574 (1): 331-341.

Giardino, M., Perotti, L., Bacenetti, M., Zamparutti, P., 2012. Climatic and structural controls to slopeinstabilities in Val Veny (Italy). Proceedings of the Second World Landslide Forum – 3-7 October 2011, Rome.

Hewitt, K., Clague, J.J., Deline, P., 2011. Catastrophic Rock Slope Failures and Mountain Glaciers. In Singh, V. P., Singh, P., Haritashya, U. K. (Eds.), Encyclopedia of Snow, Ice and Glaciers, Springer, 113-126.

Imhof, P., 2010. Glacier fluctuations in the Italian Mont Blanc massif from the Little Ice Age until the present. Historical reconstructions for the Miage, Brenva and Pré-de-Bard Glaciers. MSc Thesis, Universität Bern.

Leloup, P. H., Arnaud, N., Sobel, E. R., Lacassin, R., 2005. Alpine thermal and structural evolution of the highest external crystalline massif: The Mont Blanc. Tectonics, 24, TC4002, doi:10.1029/2004TC001676

Le Roy, M., Nicolussi, K., Deline, P., Astrade, L., Edouard, J.-L., Miramont, C., Arnaud, A., submitted. Tree-ring dating of Neoglacial glacier variations in the Western European Alps: the Mer de Glace record, Mont Blanc massif. Quaternary Science Reviews.

Margreth, S., Faillettaz, J., Funk, M., Vagliasindi, M., Diotri, F., Broccolato, M., 2011. Safety concept for hazards caused by ice avalanches from the Whymper hanging glacier in the Mont Blanc Massif. *Cold Regions Science and Technology*, 69: 194-201.

Orombelli, G. & Porter, S.C., 1988. Boulder deposit of upper Val Ferret (Courmayeur, Aosta valley): Deposit of a historic giant rockfall and debris avalanche or a late-glacial moraine ? Eclogae geologica Helvetica, 81 (2): 365-371.

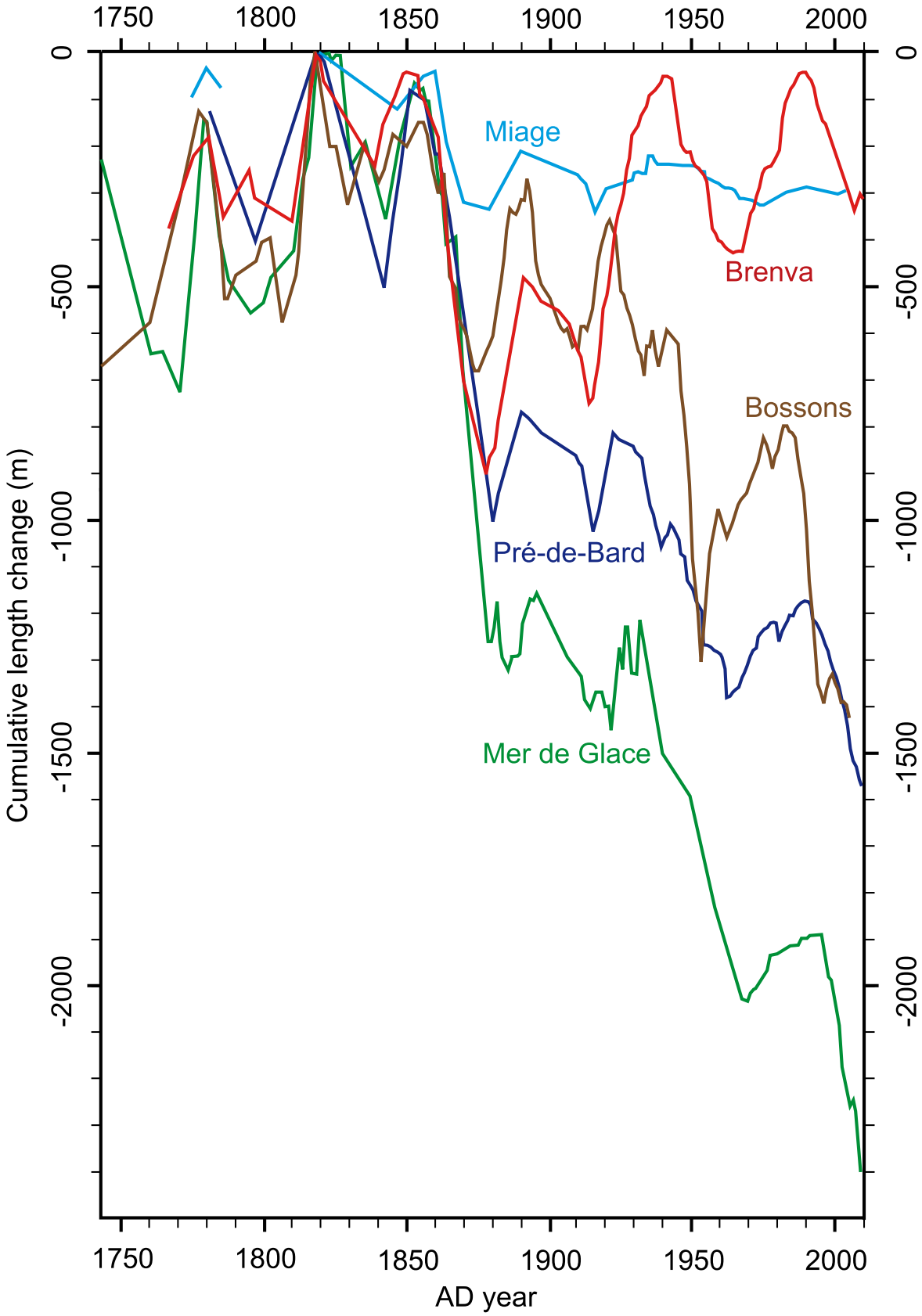
Perrel, N., 2013. Caractérisation et impacts de la séquence paraglaciaire post-PAG sur le bassin de la Mer de Glace (Massif du Mont-Blanc). MSc thesis, Université de Savoie, 141 p.

Porter, S.C. & Orombelli, G., 1980. Catastrophic rockfall of September 12, 1717 on the Italian flank of the Mont Blanc massif. *Zeitschrift für Geomorphologie*, 24 (2): 200-218.

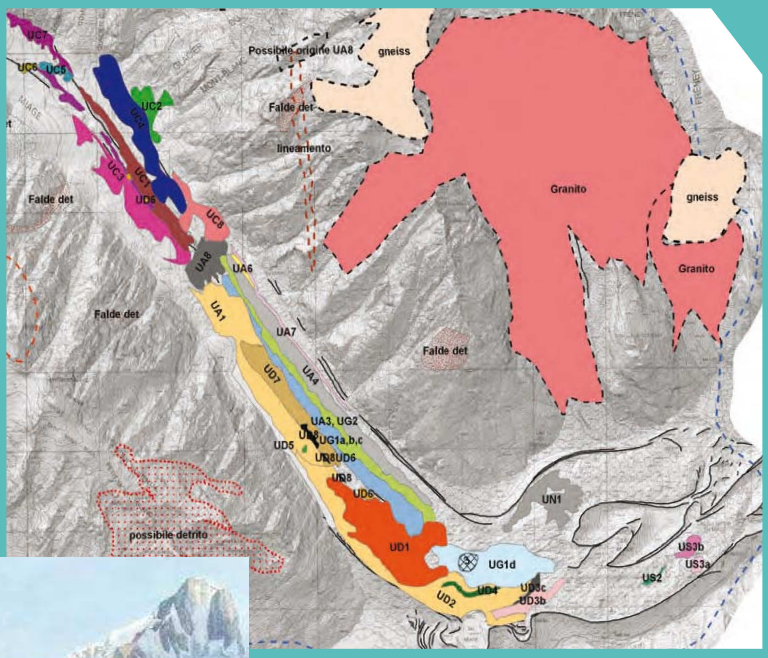
Porter, S.C. & Orombelli, G., 1982. Late-glacial ice advances in the western Italian Alps. *Boreas*, 11: 125-140.

Raoul-Rochette, D., 1826. Voyage pittoresque dans la Vallée de Chamouni et autour du Mont-Blanc. D'Ostervald, Paris.

Zamparutti, P., 2010. Il Ghiacciao del Miage: cartografia geomorfologica e studio della copertura detritica attraverso tecniche di fotogrammetria digitale e telerilevamento. MSc thesis, Università di Torino.



15- Cumulative length variations of five glaciers in the Mont Blanc massif since the end of the 18th century, relative to their maximum extent around 1818–1821 (Deline et al., 2012). Pré-de-Bard and the two large debriscovered Brenva and Miage are located on the Italian side of the massif.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