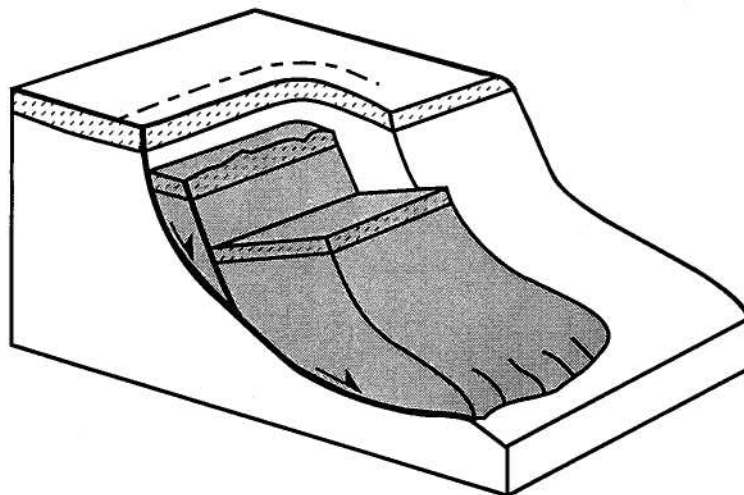


The International Geotechnical Societies'
UNESCO Working Party for
World Landslide Inventory © 1993

MULTILINGUAL LANDSLIDE GLOSSARY



The Canadian Geotechnical Society

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Have the Glossary punched on its left hand margin for insertion in a ring binder of your choice. You will then be able to add new sections (and new Indexes and Tables of Contents) as they become available.

Introduction

In his call for the International Decade for Natural Disaster Reduction (1990-2000), the Secretary-General of the United Nations remarked, "A fundamental precondition for improvements in risk-assessment and disaster management capabilities is the availability of reliable historical data on disasters on a country-by-country basis."

Landslides, either alone or in association with the earthquakes, volcanic eruptions, wildfires and major rainstorms that may trigger landslides, are a major cause of loss of life, injury and property damage in natural disasters around the world. In some countries, they are the major cause of damage. So the need to establish a World Landslide Inventory is apparent. The world distribution of landslides has not yet been mapped. Landslide studies are isolated, limiting their interpretation to local factors. Analyzing the occurrence of groups of landslides will reveal the broad processes, active over a number of sites, that contribute to slope movements. There is an obvious analogy to be drawn with the study of earthquakes, now synthesized by the theory of plate tectonics.

The International Geotechnical Societies' UNESCO Working Party on World Landslide Inventory (abbreviated WP/WLI) was initiated at the 5th International Symposium on Landslides (Lausanne, 1988) to assist the establishment of a detailed list of the World's landslides. To do this, the Working Party has prepared a Suggested Method for the creation of the basic unit of the Inventory, the Landslide Report (WP/WLI, 1990) and suggested how Landslide Reports can be compiled in a Landslide Summary (WP/WLI, 1991). Working Groups have been set up by the Working Party to suggest methods of classifying the rates of movement of landslides, their causes, their geology, their activity and the distribution of movement within landslides (WP/WLI, 1993).

The Working Party has informally defined a landslide (Cruden, 1991) as, "A movement of a mass of rock, earth or debris down a slope". Ground subsidence and snow avalanches are beyond its scope but debris flows, for instance, interest the Party.

To ensure adequate communication between Groups working in different languages, the Working Party has drawn on its membership to translate the basic terms used in its Report and Suggested Methods into Chinese, French, German, Spanish, and Russian from agreed English texts.

In the English edition of the Multilingual Glossary the English terms in each section of the Glossary have been arranged facing an explanatory diagram. Terms in other languages follow, numbered with the same page number as the corresponding English page. The index of terms in English lists the terms by section number followed by the number of the term in the section and in the explanatory diagram.

The Suggested Methods of the Working Party on World Landslide Inventory are reviewed by the whole Working Party and published when a consensus has been reached. Published Methods are listed in the References, the membership of the Working Party numbers 49 and has recently been listed in Brown, Cruden, and Dennison (1992).

Further editions of the Glossary will be published as Working Groups of the Working Party complete Suggested Methods or expand existing Suggested Methods and as the Glossary is translated into other languages. Detailed lists of the availability of the Glossary will be lodged with the Secretariats of the International Geotechnical Societies and the Editors of the Glossary (listed in the Acknowledgements). Colour slides of the diagrams are available as a set through the ISSMFE Educational Slide Set Program. Write to the Secretary-General, ISSMFE. The diagrams have been copyrighted. They have been specifically produced by computer graphics for this edition. They may not be reproduced without permission of the Editor.

Acknowledgements

The project has been coordinated by E. Krauter who also edited the German text. Chinese text was provided by Z-Y. Zhang, English by D.M. Cruden, French by G. Lefèbvre, Spanish by L. Beltran and Russian by G. Ter-Stepanian. The authors welcome your comments. Their addresses are:

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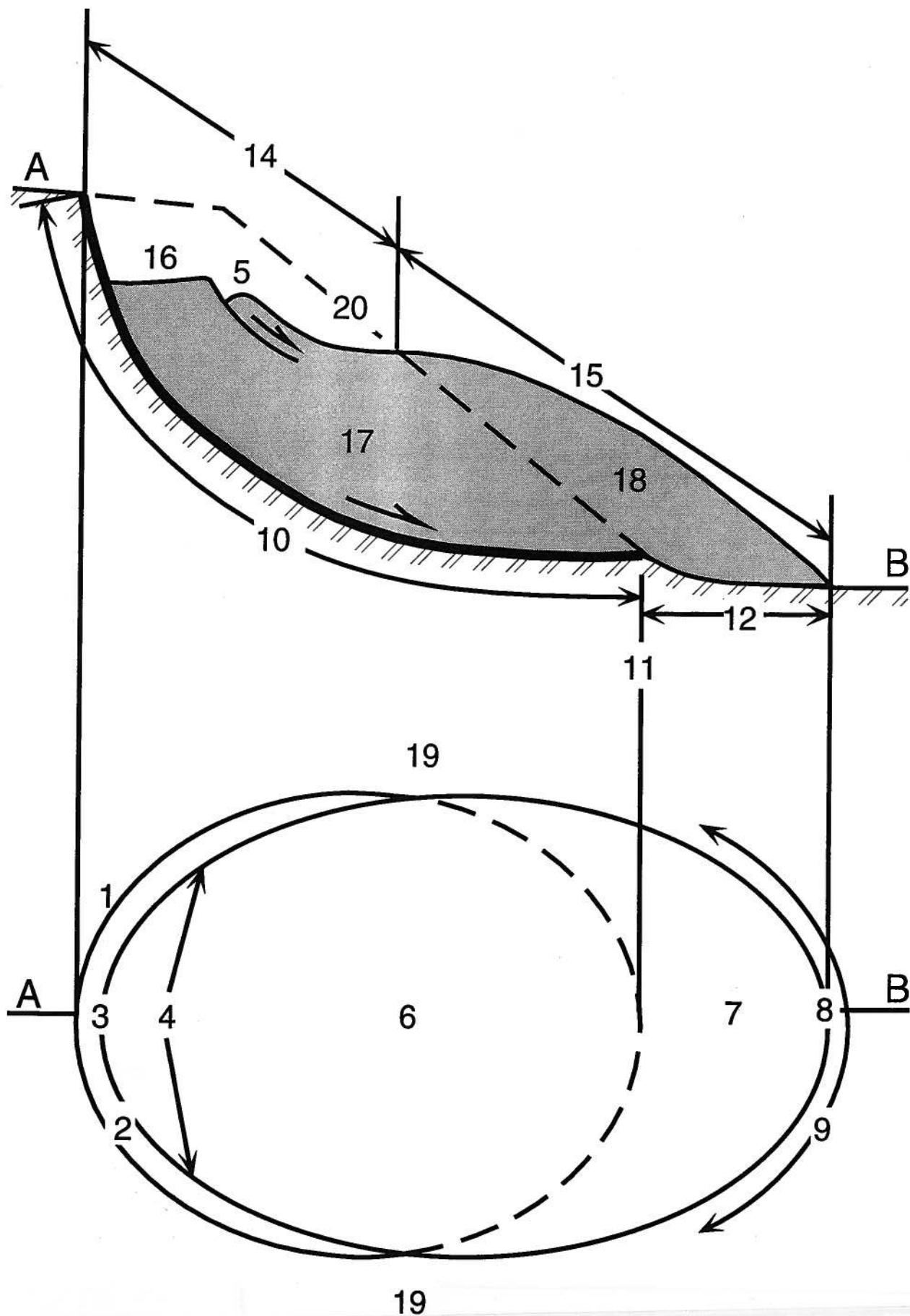
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1. Landslide Features



1. Landslide Features

- 1)**Crown:** The practically undisplaced material still in place and adjacent to the highest parts of the main scarp (2).
- 2)**Main scarp:** A steep surface on the undisturbed ground at the upper edge of the landslide, caused by movement of the displaced material (13) away from the undisturbed ground. It is the visible part of the surface of rupture (10).
- 3)**Top:** The highest point of contact between the displaced material (13) and the main scarp (2).
- 4)**Head:** The upper parts of the landslide along the contact between the displaced material and the main scarp (2).
- 5)**Minor scarp:** A steep surface on the displaced material of the landslide produced by differential movements within the displaced material.
- 6)**Main body:** The part of the displaced material of the landslide that overlies the surface of rupture (10) between the main scarp (2) and the toe of the surface of rupture (11).
- 7)**Foot:** The portion of the landslide that has moved beyond the toe of the surface of rupture (11) and overlies the original ground surface (20).
- 8)**Tip:** The point on the toe (9) farthest from the top (3) of the landslide.
- 9)**Toe:** The lower, usually curved margin of the displaced material of a landslide, it is the most distant from the main scarp (2).
- 10)**Surface of rupture:** The surface which forms (or which has formed) the lower boundary of the displaced material (13) below the original ground surface (20).
- 11)**Toe of surface of rupture:** The intersection (usually buried) between the lower part of the surface of rupture (10) of a landslide and the original ground surface (20).
- 12)**Surface of separation:** The part of the original ground surface (20) overlain by the foot (7) of the landslide.
- 13)**Displaced material:** Material displaced from its original position on the slope by movement in the landslide. It forms both the depleted mass (17) and the accumulation (18).
- 14)**Zone of depletion:** The area of the landslide within which the displaced material lies below the original ground surface (20).
- 15)**Zone of accumulation:** The area of the landslide within which the displaced material lies above the original ground surface (20).
- 16)**Depletion:** The volume bounded by the main scarp (2), the depleted mass (17) and the original ground surface (20).
- 17)**Depleted mass:** The volume of the displaced material which overlies the rupture surface (10) but underlies the original ground surface (20).
- 18)**Accumulation:** The volume of the displaced material (13) which lies above the original ground surface (20).
- 19)**Flank:** The undisplaced material adjacent to the sides of the rupture surface. Compass directions are preferable in describing the flanks but if left and right are used, they refer to the flanks as viewed from the crown (1).
- 20)**Original ground surface:** The surface of the slope that existed before the landslide took place.

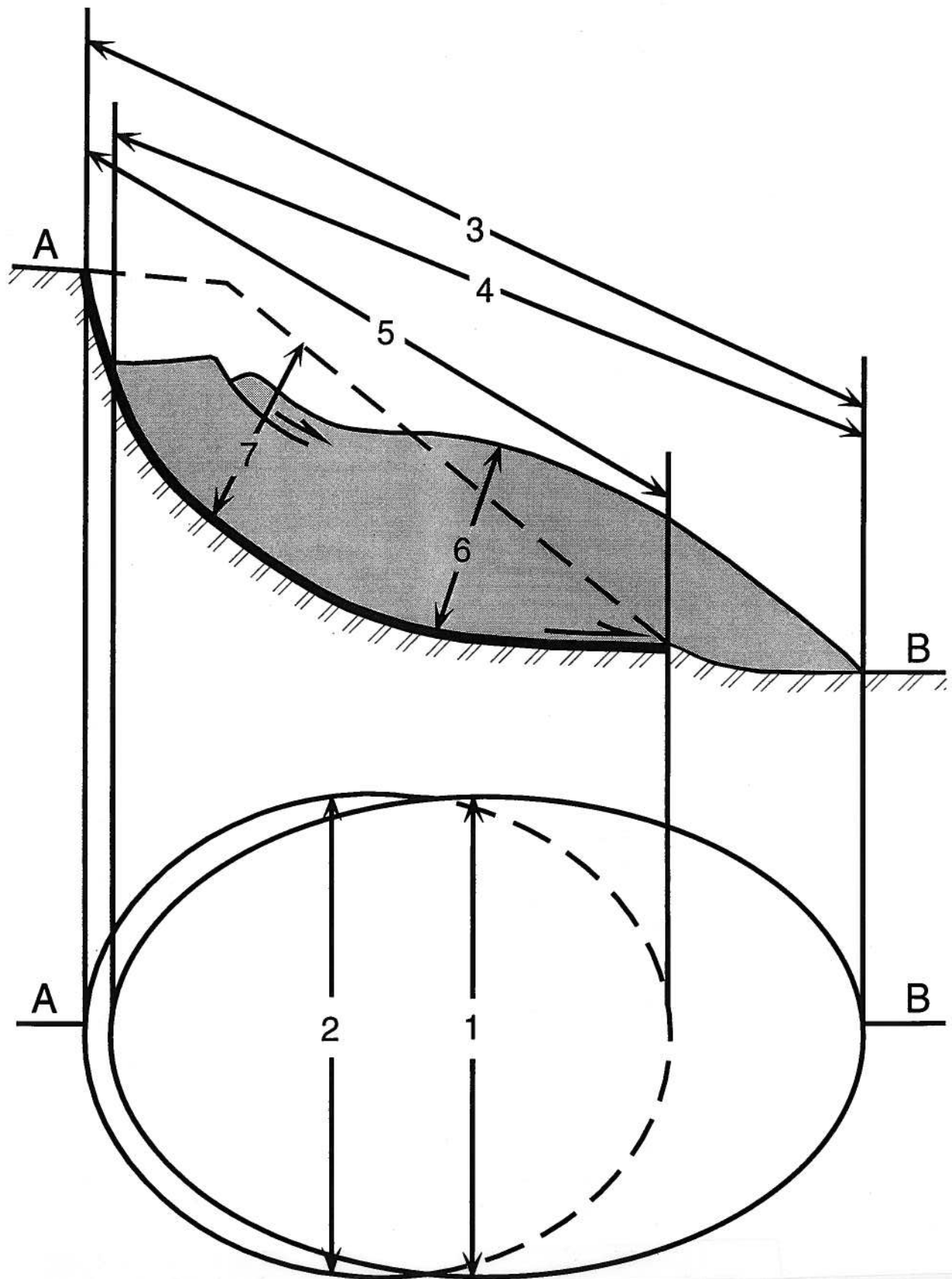
Figure Legend. Cross hatching indicates undisturbed ground, stippling shows the extent of the displaced material (13).

Caractéristiques des glissements de terrain

- 1) **Couronne:** Zone pratiquement intacte située au-dessus de l'escarpement principal (2).
- 2) **Escarpement principal:** Surface abrupte limitant le glissement à son extrémité supérieure. C'est la partie visible de la surface de rupture (10).
- 3) **Sommet:** Limite supérieure du glissement, point le plus élevé où le matériau déplacé (13) est en contact avec l'escarpement principal (2).
- 4) **Tête:** Parties supérieures du glissement où la masse déplacée est en contact avec l'escarpement principal (2).
- 5) **Escarpement secondaire:** Escarpement dans la masse déplacée causé par les mouvements différentiels à l'intérieur du matériau déplacé.
- 6) **Corps:** Partie du matériau déplacé (13) au-dessus de la surface de rupture (10) située entre l'escarpement principal (2) et le pied de la surface de rupture (11).
- 7) **Pied:** Partie de la masse déplacée (13) recouvrant la surface topographique originale (20) en aval du pied de la surface de rupture (11).
- 8) **Extrémité aval:** Point le plus aval du matériau déplacé (13).
- 9) **Front:** Partie la plus aval, par rapport à l'escarpement principal (2), généralement de forme convexe.
- 10) **Surface de rupture:** Prolongation en profondeur de l'escarpement principal (2) au-dessous de la masse déplacée (13) et de la surface topographique originale (20).
- 11) **Pied de la surface de rupture:** Point d'intersection aval (généralement enterré) de la surface de rupture (10) et la surface topographique originale (20).
- 12) **Surface de séparation:** Portion de la surface topographique originale recouverte par le pied du glissement (7).
- 13) **Matériau déplacé:** Matériau qui a subi un déplacement suite au glissement. Il forme la masse affaissée (17) et l'accumulation (18).
- 14) **Zone d'affaissement:** Zone d'un glissement de terrain où la masse déplacée se retrouve au-dessous de la surface topographique originale (20).
- 15) **Zone d'accumulation:** Zone d'un glissement de terrain où la masse déplacée se retrouve au-dessus de la surface topographique originale (20).
- 16) **Dépression:** Volume délimité par l'escarpement principal (2), la masse affaissée (17) et la surface topographique originale (20).
- 17) **Masse affaissée:** Partie de la masse déplacée délimitée par la surface de rupture (10) et située sous la surface topographique originale (20).
- 18) **Accumulation:** Partie de la masse déplacée située au-dessus de la surface topographique originale (20).
- 19) **Flanc:** Limite latérale du glissement joignant l'escarpement principal. Les points cardinaux sont préférablement utilisés dans la description des flancs. Si les termes droit et gauche sont utilisés, ceux-ci sont localisés tels que vu de la couronne (1).
- 20) **Surface topographique originale:** Surface du terrain avant l'occurrence du glissement.

Légende de la figure. La surface hachurée indique les zones demeurées intactes. La surface en pointillé montre l'étendue des matériaux déplacés (13).

2. Landslide Dimensions



2. Landslide Dimensions

- 1) The **width of the displaced mass**, W_d , is the maximum breadth of the displaced mass perpendicular to the length, L_d .
- 2) The **width of the rupture surface**, W_r , is the maximum width between the flanks of the landslide, perpendicular to the length, L_r .
- 3) The **total length**, L , is the minimum distance from the tip of the landslide to its crown.
- 4) The **length of the displaced mass**, L_d , is the minimum distance from the tip to the top.
- 5) The **length of the rupture surface**, L_r , is the minimum distance from the toe of the surface of rupture to the crown.
- 6) The **depth of the displaced mass**, D_d , is the maximum depth of the displaced mass, measured perpendicular to the plane containing W_d and L_d .
- 7) The **depth of the rupture surface**, D_r , is the maximum depth of the rupture surface below the original ground surface measured perpendicular to the plane containing W_r and L_r .

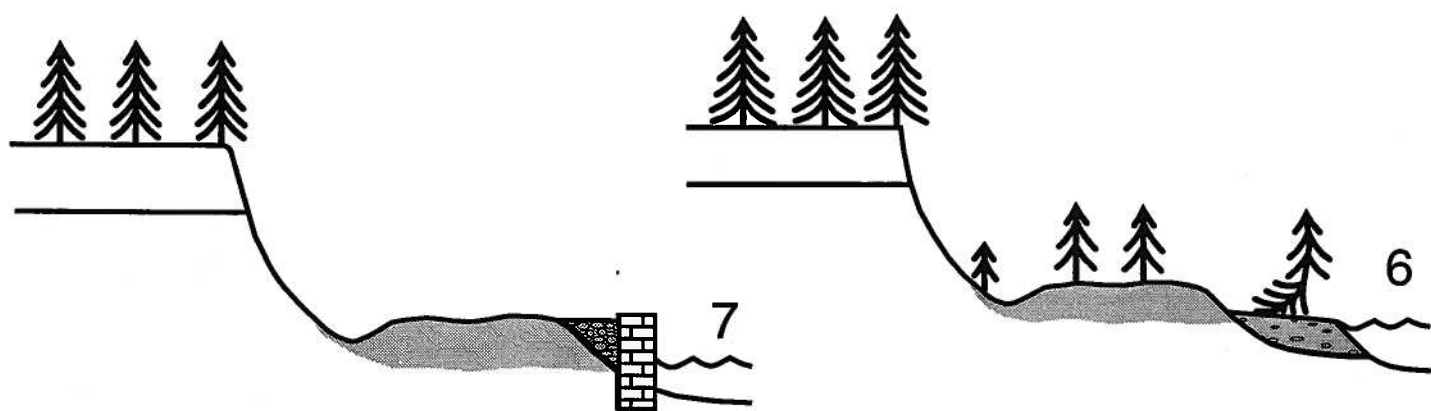
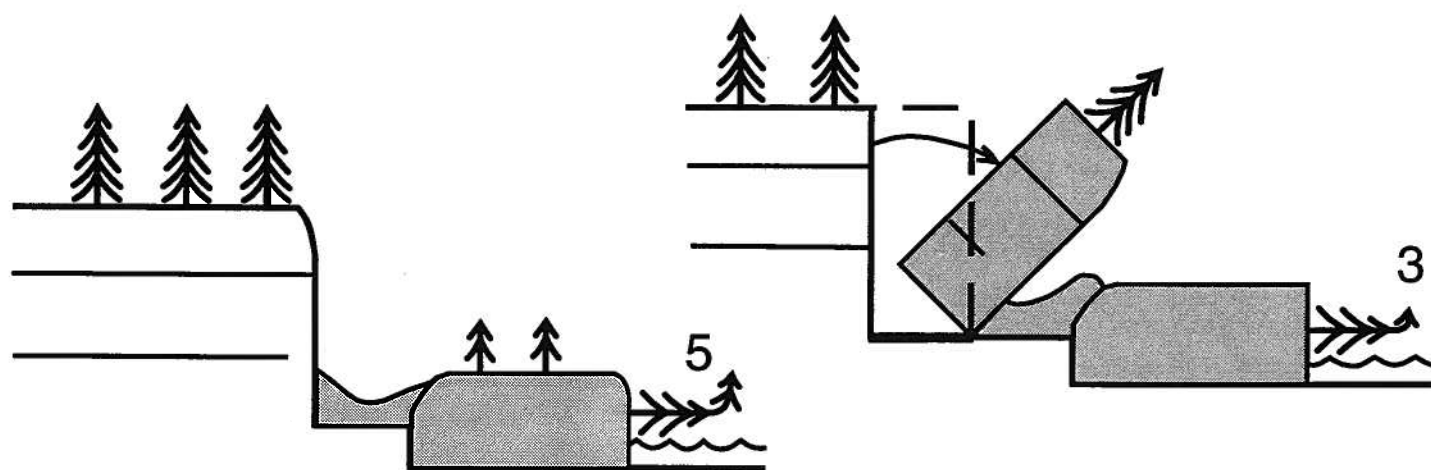
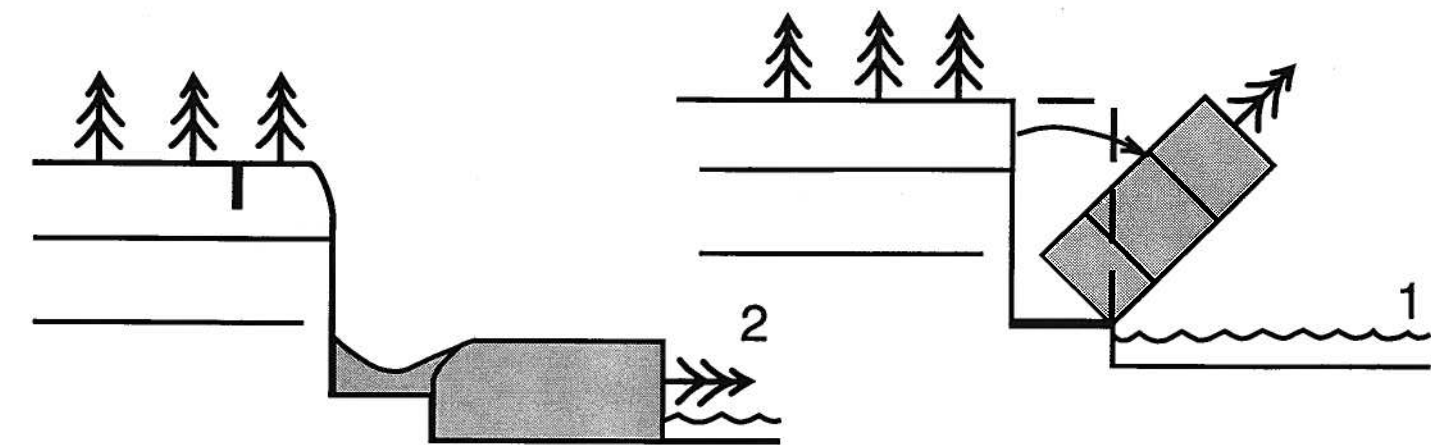
Figure Legend. Cross hatching indicates undisturbed ground.

Dimensions des glissements de terrain

- 1) **Largeur de la masse déplacée, W_d :** largeur maximale de la masse déplacée dans une direction perpendiculaire à la longueur, L_d .
- 2) **Largeur de la surface de rupture, W_r :** distance maximale entre les flancs dans une direction perpendiculaire à la longueur de la surface de rupture L_r .
- 3) **Longueur totale, L :** distance minimale entre la couronne et l'extrémité aval du glissement.
- 4) **Longueur de la masse déplacée, L_d :** distance minimale entre l'extrémité inférieure et le sommet de la masse déplacée.
- 5) **Longueur de la surface de rupture, L_r :** distance minimale entre le pied de la surface de rupture et la couronne.
- 6) **Profondeur de la masse déplacée, D_d :** profondeur maximale de la masse déplacée mesurée perpendiculairement au plan formé par W_d et L_d .
- 7) **Profondeur de la surface de rupture, D_r :** distance maximale entre la surface de rupture et la surface topographique originale, mesurée perpendiculairement au plan formé par W_r et L_r .

Légende de la figure. La partie hachurée indique les zones demeurées intactes.

3. States of Activity of Landslides



3. States of Activity of Landslides

- 1) An **active** landslide is currently moving.
- 2) A **suspended** landslide has moved within the last 12 months but is not active (1) at present.
- 3) A **reactivated** landslide is an active (1) landslide which has been inactive (4).
- 4) An **inactive** landslide has not moved within the last 12 months.
Inactive landslides can be subdivided into states 5-8.
- 5) A **dormant** landslide is an inactive (4) landslide which can be reactivated (3) by its original causes or by other causes.
- 6) An **abandoned** landslide is an inactive (4) landslide which is no longer affected by its original causes.
- 7) A **stabilized** landslide is an inactive (4) landslide which has been protected from its original causes by artificial remedial measures.
- 8) A **relict** landslide is an inactive (4) landslide which developed under climatic or geomorphological conditions considerably different from those at present.

Figure legend. Sections through topples in different states of activity.

1) **Active**, erosion at the toe of the slope causes a block to topple. 2) **Suspended**, local cracking in the crown of the topple. 3) **Reactivated**, another block topples, disturbing the previously displaced material. 5) **Dormant**, the displaced mass begins to regain its tree cover, scarps are modified by weathering. 6) **Abandoned**, fluvial deposition has protected the toe of the slope, the scarp begins to regain its tree cover. 7) **Stabilized**, a wall protects the toe of the slope. 8) **Relict**, uniform tree cover has been established.

États d'activité des glissements de terrain *

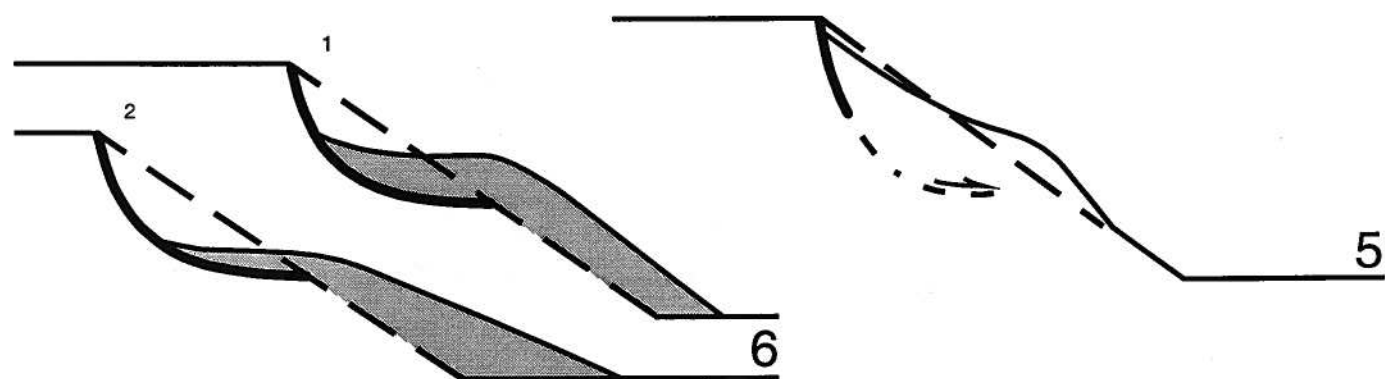
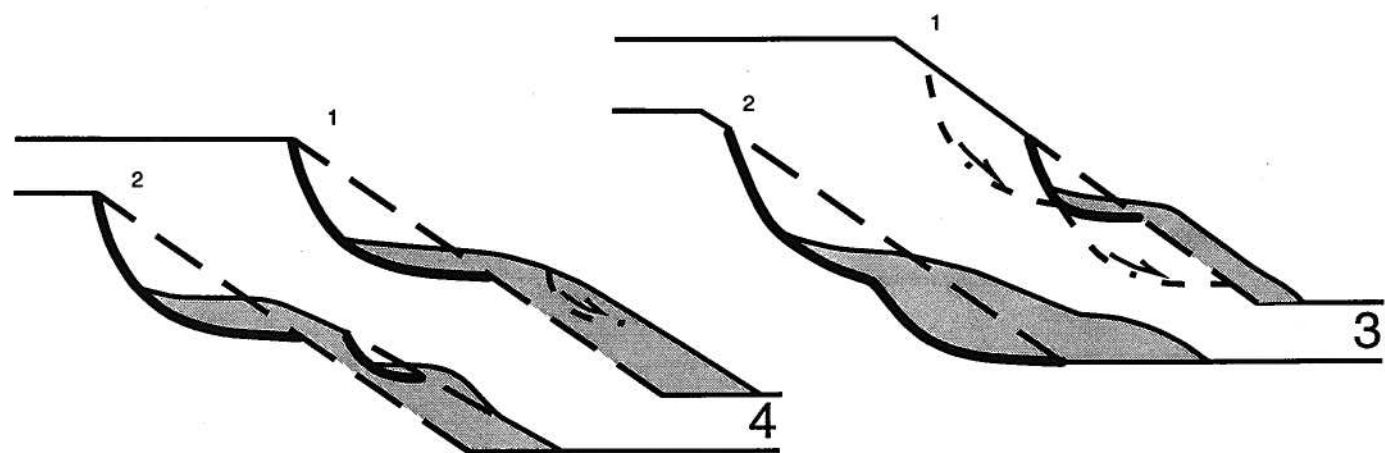
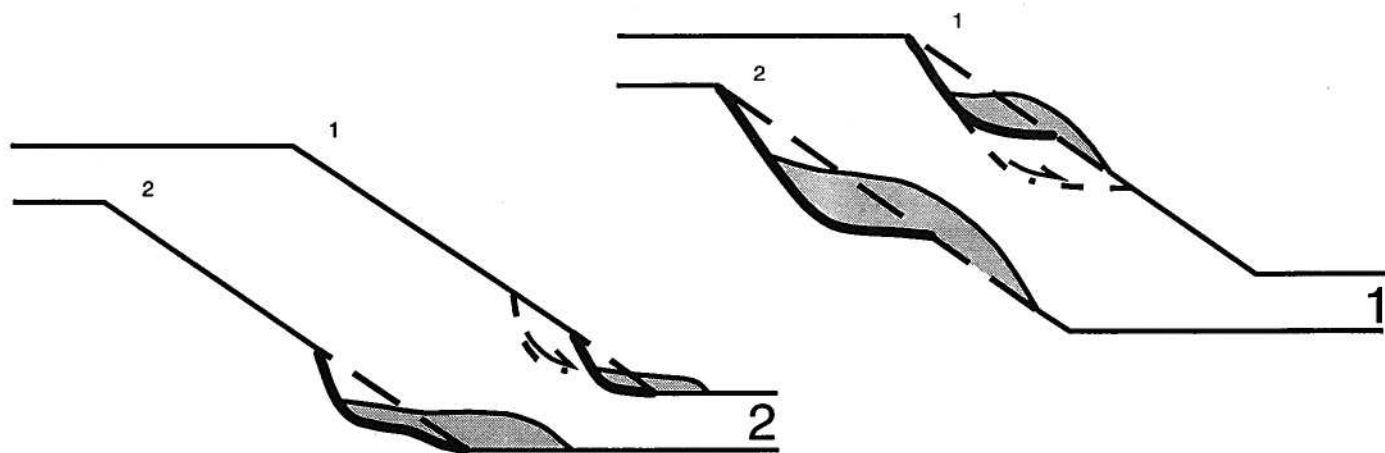
- 1) Glissement de terrain **actif**: actuellement en mouvement.
- 2) Glissement **en suspens**: en mouvement depuis les 12 derniers mois mais sans être actif (1) pour le moment.
- 3) Glissement de terrain **réactivé**: glissement actif (1) ayant déjà été inactif (4).
- 4) Glissement de terrain **inactif**: n'a pas été en mouvement depuis les 12 derniers mois.
Les glissements de terrain inactifs se caractérisent par les différents états (5 à 8).
- 5) Glissement de terrain **latent**: glissement inactif (4) pouvant être réactivé (3) pour les mêmes causes qui sont à son origine.
- 6) Glissement de terrain **naturellement stabilisé**: glissement inactif (4) n'étant plus soumis aux causes qui sont à son origine.
- 7) Glissement de terrain **artificiellement stabilisé**: glissement inactif (4) isolé des causes qui sont à son origine par des moyens artificiels.
- 8) Glissement de terrain **ancien**: glissement inactif (4) développé sous des conditions climatiques et géomorphologiques sensiblement différentes de celles existant aujourd'hui.

* Le terme glissement est ici utilisé au sens général et inclut tous les types de mouvement de terrain.

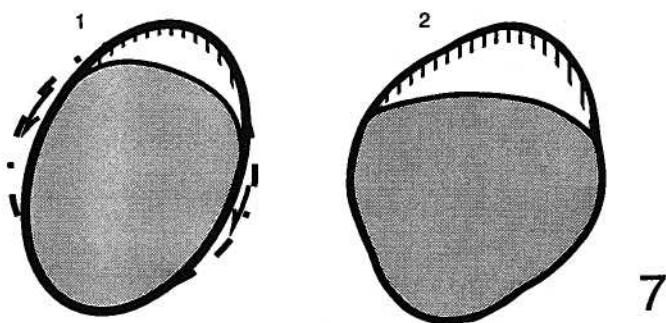
Légende des figures: coupes transversales de talus montrant différents états d'activités.

1) **Actif**, basculement d'un bloc de terrain causé par l'érosion au pied du talus. 2) **En suspens**, fissure en crête du talus. 3) **Ré-actif**, basculement d'un autre bloc de terrain, remaniant les matériaux déposés par le premier glissement. 5) **Latent**, les arbres commencent à recouvrir l'éboulis, les escarpements sont altérés par les intempéries. 6) **Naturellement stabilisé**, le pied de la pente a été protégé des dépôts fluviaux, les arbres commencent à recouvrir l'escarpement. 7) **Artificiellement stabilisé**, le pied de la pente est protégé par un mur. 8) **Ancien**, une végétation arborescente s'est développée.

4. Distributions of Activity in Landslides



0 6 12 18 m



4. Distributions of Activity in Landslides

- 1) In an **advancing** landslide the rupture surface is extending in the direction of movement.
- 2) In a **retrogressive** landslide the rupture surface is extending in the direction opposite to the movement of the displaced material.
- 3) In an **enlarging** landslide the rupture surface of the landslide is extending in two or more directions.
- 4) In a **diminishing** landslide the volume of the displacing material is decreasing.
- 5) In a **confined** landslide there is a scarp but no rupture surface visible at the foot of the displaced mass.
- 6) In a **moving** landslide the displaced material continues to move without any visible change in the rupture surface and the volume of the displaced material.
- 7) In a **widening** landslide the rupture surface is extending into one or both flanks of the landslide.

Figure Legend. Landslides showing different distributions of activity.

1) **Advancing**, 2) **Retrogressing**, 3) **Enlarging**, 4) **Diminishing**, 5) **Confined**, 6) **Moving**, 7) **Widening** (plan view). Section 2 of the diagrams shows the slope after movement on the rupture surface indicated by the shear arrow in the section. Displaced material is stippled.

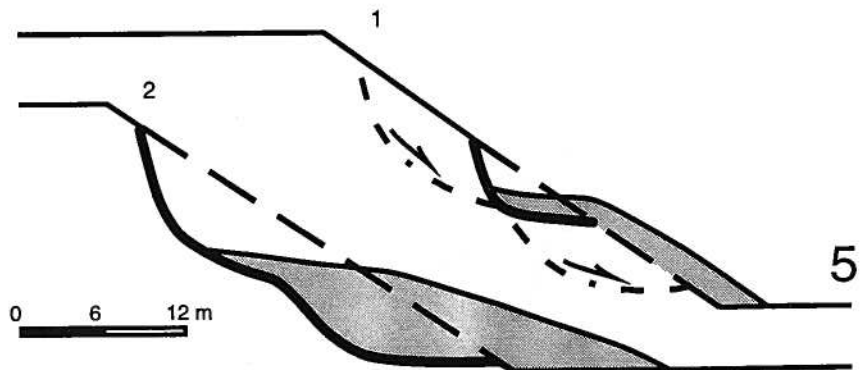
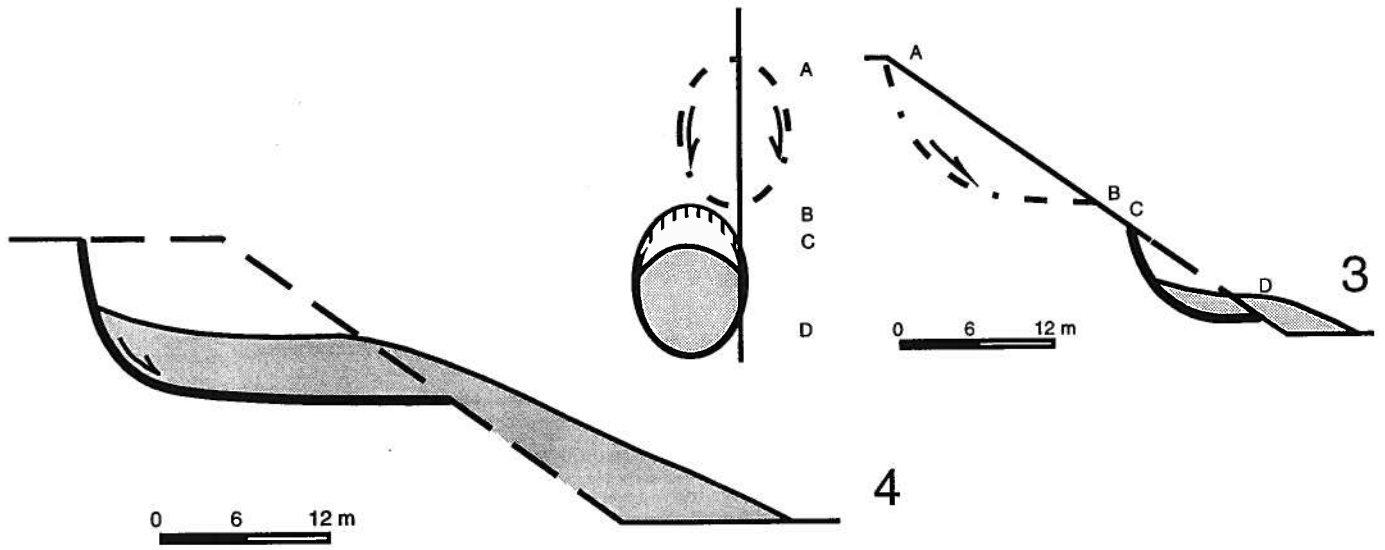
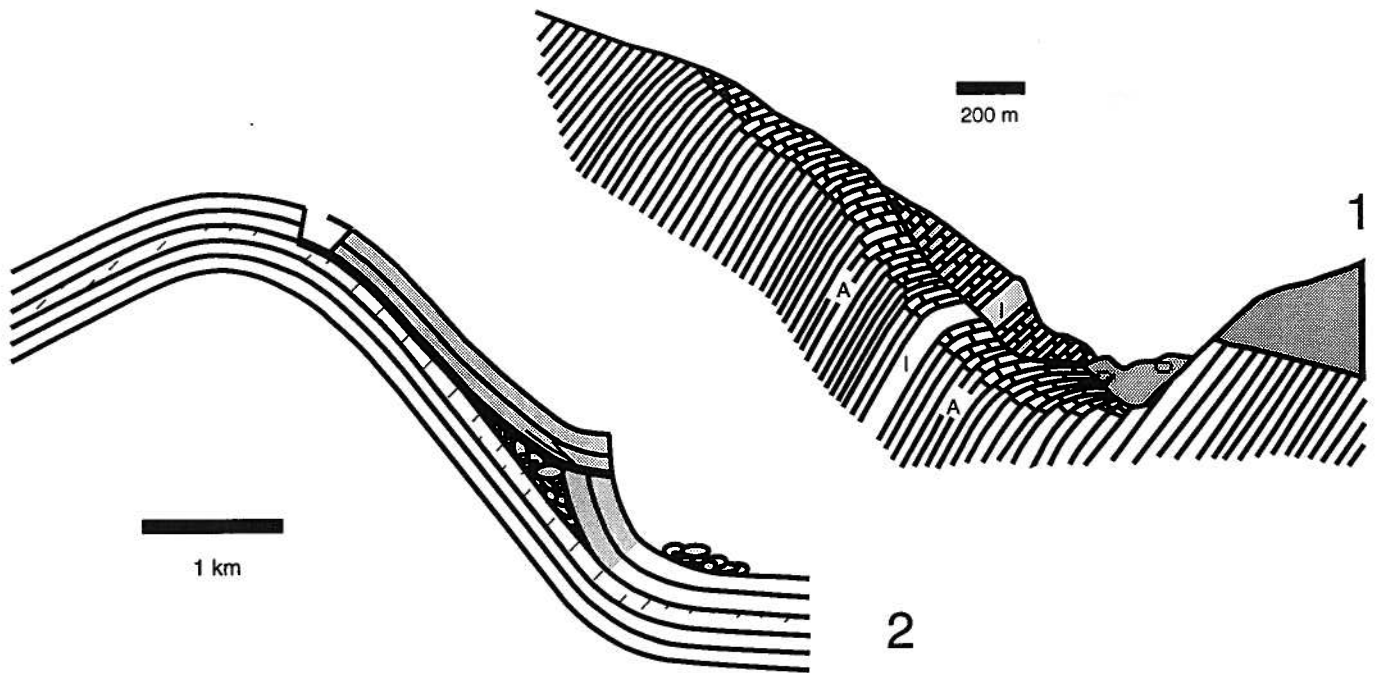
Distribution des mouvements dans les glissements de terrain

- 1) Glissement de terrain **en extension avale**: la surface de rupture du glissement progresse dans la direction du mouvement.
- 2) Glissement de terrain **rétrogressif**: la surface de rupture du glissement progresse suivant la direction opposée au mouvement des matériaux déplacés.
- 3) Glissement de terrain **en extension multi-directionnelle**: la surface de rupture progresse suivant deux ou plusieurs directions.
- 4) Glissement de terrain **en régression**: le volume des matériaux déplacés diminue.
- 5) Glissement de terrain **contenu**: il y a formation d'un escarpement en crête sans qu'aucune surface de rupture soit visible au pied de la masse déplacée.
- 6) Glissement de terrain **en mouvement**: la masse déplacée continue d'avancer sans aucun changement visible de la surface de rupture ou du volume des matériaux déplacés.
- 7) Glissement de terrain **en extension latérale**: la surface de rupture progresse sur un seul ou sur les deux flancs du glissement.

Légende des figures: Différentes distributions des mouvements des glissements de terrain.

1) **Avancement**, 2) **Rétrogressif**, 3) **Multi-directionnel**, 4) **Régressif**, 5) **Confiné**, 6) **Constant**, 7) **Élargissement** (vue en plan). La section 2 des figures montre les talus après déplacement sur la surface de rupture indiquée par une flèche. Le volume de matériau déplacé est tramé.

5. Styles of Landslide Activity



5. Styles of Landslide Activity

- 1) A **complex** landslide exhibits at least two types of movement (falling, toppling, sliding, spreading, flowing) in sequence.
- 2) A **composite** landslide exhibits at least two types of movement simultaneously in different parts of the displacing mass.
- 3) A **successive** landslide is the same type as a nearby, earlier landslide but does not share displaced material or a rupture surface with it.
- 4) A **single** landslide is a single movement of displaced material.
- 5) A **multiple** landslide shows repeated development of the same type of movement.

Figure Legend. Landslides showing different styles of activity.

1) **Complex.** Gneiss (A) and migmatites (I) toppled with valley incision. Alluvial deposits filled in the valley bottom. After weathering weakened the toppled material, some of the displaced mass slid.
2) **Composite.** Limestones have slid on the underlying shales causing toppling below the toe of the slide rupture surface. 3) **Successive.** The later slide, AB, is the same type as slide, DC, but does not share displaced material or a rupture surface with it. 4) **Single.** 5) **Multiple.**

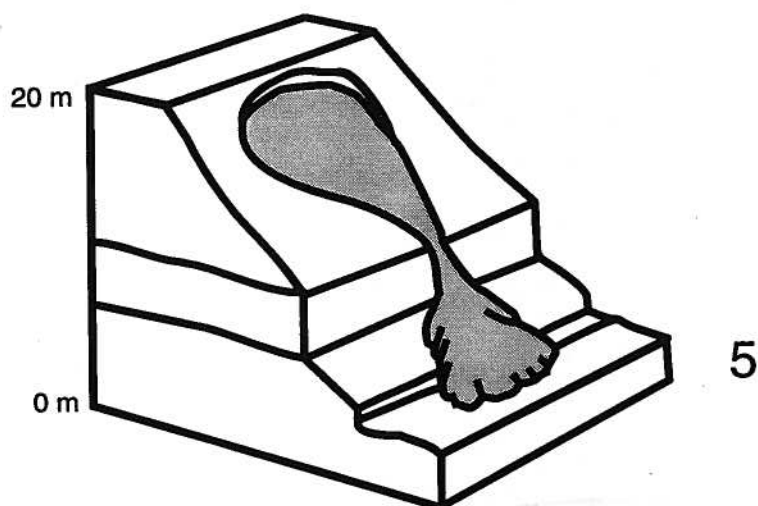
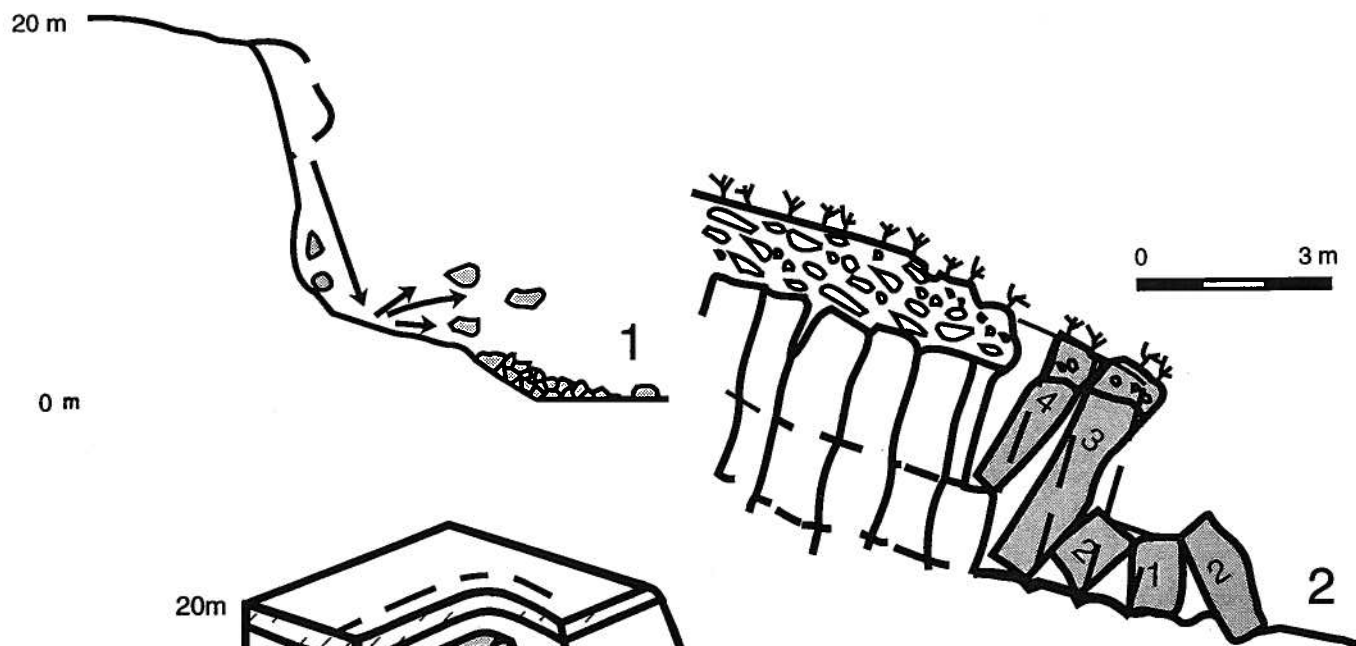
Morphologie des glissements de terrain

- 1) Un glissement de terrain **complexe** montre une séquence d'au moins deux types de mouvements (décrochement, basculement, glissement, étalement, écoulement).
- 2) Un glissement de terrain **composé** montre au moins deux types de mouvements simultanés dans différents endroits de la masse en déplacement.
- 3) Un glissement de terrain **successif** est de même type qu'un glissement antérieur adjacent sans cependant partager la même masse déplacée ou la même surface de rupture.
- 4) Un glissement de terrain **simple** se caractérise par un seul déplacement de masse.
- 5) Un glissement de terrain **multiple** correspond à des mouvements répétés d'un même type.

Légende des figures: Différentes morphologies des glissements de terrain.

1) **Complexe**, les gneiss (A) et migmatites (I) ont basculé lors du creusement de la vallée. Des dépôts alluviaux ont comblé le creux de la vallée. La masse renversée a glissé suite à son affaiblissement par les intempéries. 2) **Composé**, la roche calcaire a glissé sur le schiste sous-jacent provoquant un basculement en dessous de la base de la surface de rupture du glissement. 3) **Successif**, le glissement ultérieur, AB, est de même type que le glissement, DC, sans partager la même masse déplacée ou la même surface de rupture. 4) **Simple**. 5) **Multiple**.

6. Types of Landslides



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- 1) A **fall** starts with the detachment of soil or rock from a steep slope along a surface on which little or no shear displacement takes place. The material then descends largely through the air by falling, saltation or rolling.
- 2) A **topple** is the forward rotation, out of the slope, of a mass of soil or rock about a point or axis below the centre of gravity of the displaced mass.
- 3) A **slide** is the downslope movement of a soil or rock mass occurring dominantly on surfaces of rupture or relatively thin zones of intense shear strain.
- 4) A **spread** is an extension of a cohesive soil or rock mass combined with a general subsidence of the fractured mass of cohesive material into softer underlying material. The rupture surface is not a surface of intense shear. Spreads may result from liquefaction or flow (and extrusion) of the softer material.
- 5) A **flow** is a spatially continuous movement in which surfaces of shear are short-lived, closely spaced and not usually preserved. The distribution of velocities in the displacing mass resembles that in a viscous fluid.

Figure Legend. Broken lines indicate the original ground surface. Arrows show portions of the trajectories of individual particles of the displaced mass.

Types de mouvements de terrain

- 1) **Éboulement:** La masse de sol ou de roc se détache d'une pente abrupte avec peu ou pas de déformations préalable le long de la surface de rupture puis dégringole librement.
- 2) **Basculement:** Mouvement de rotation vers l'extérieur de la pente, par rapport à un point ou un axe inférieur au centre de gravité de la masse de sol ou de roc déplacée.
- 3) **Glissement:** Mouvement vers le bas de la pente d'une masse de sol ou de roc se produisant principalement sur des surfaces de rupture ou dans des zones de cisaillement relativement minces.
- 4) **Étalement:** Mouvement d'une masse de sol cohésif ou de roc suite à l'extrusion et le déplacement d'une couche sous-jacente de matériaux plus faibles, accompagnés de l'affaissement de la masse fracturée. Les étalements peuvent être causés par la liquéfaction ou l'écoulement du matériau mou.
- 5) **Écoulement:** Mouvement continu réparti dans la masse déplacée semblable à celui d'un fluide visqueux.

Légende des figures. La surface topographique originale est montrée par des traits discontinus. Les trajectoires des particules individuelles de la masse déplacée sont indiquées par des flèches.

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