TEMA 2. DETERMINACIÓN DE LA FRECUENCIA DE PROCESOS GEOLÓGICOS

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2.1. Escalas temporales de los procesos geológicos y de los registros instrumental, histórico y geológico

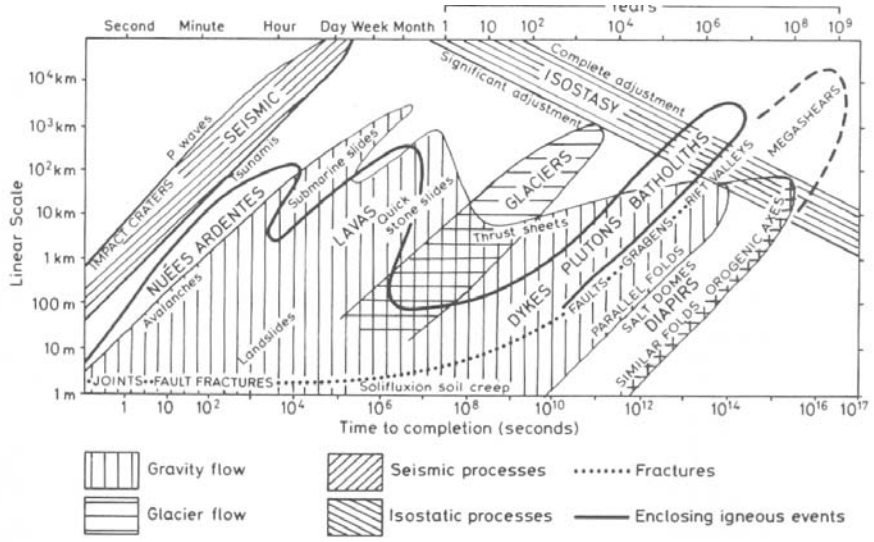


Figure 1.8 A size-time model for diastrophic and geomorphic processes. Most displacements are completed in times proportional to their sizes and form an *en échelon* sequence sloping up to the right at 45°, indicating that larger-scale movements are accomplished in generally longer time periods. The sequence of such movements is arranged from left to right with lower viscosity materials on the left. These sloping units do not take account of the episodic nature of many movements – e.g. a significant proportion of glacier movements takes place by surges having a periodicity of the order of 10–100 years. Contrasting with the above movements are isostatic recoveries (sloping down to the right at 30°) with large areas achieving general recovery more rapidly than smaller locations.
Source: Carey, 1962, figure 1, p. 98.

- **Duración vs. Frecuencia**

- **Frecuencia y magnitud**

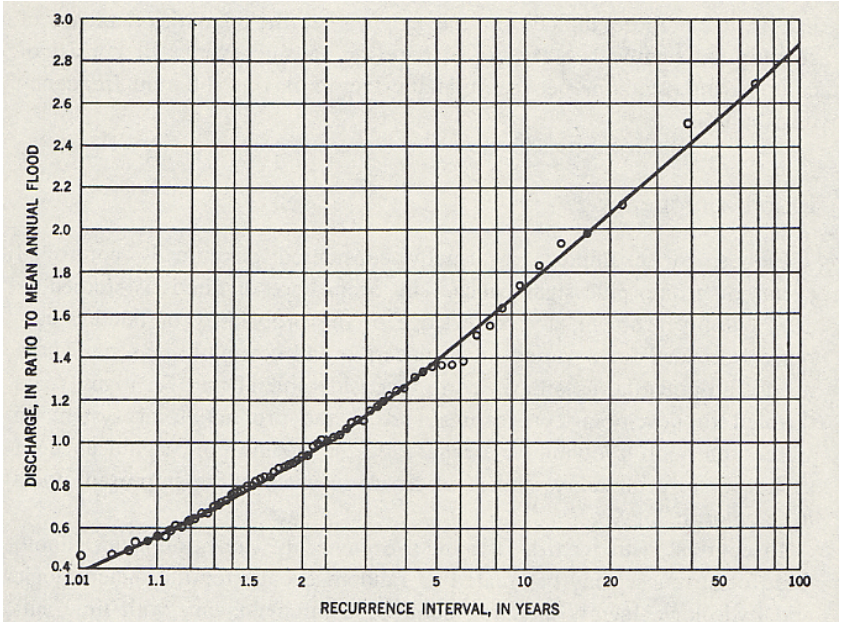


Figure 3-14. *Regional flood-frequency curve for Youghiogheny and Kiskiminetas river basins, Pennsylvania. To determine the recurrence interval of a particular flood flow at point, the mean annual flood at that point is measured or estimated; the ratio of the flood flow to the annual flood is then entered on the ordinate and the recurrence interval of the flood is read on the abscissa.*

Determinación de la actividad de fenómenos geológicos

Determinación de la duración, de la frecuencia, de la magnitud (y de la intensidad)

- **Procesos activos**
- **Procesos periódicos: cuestiones de escala temporal de observación**

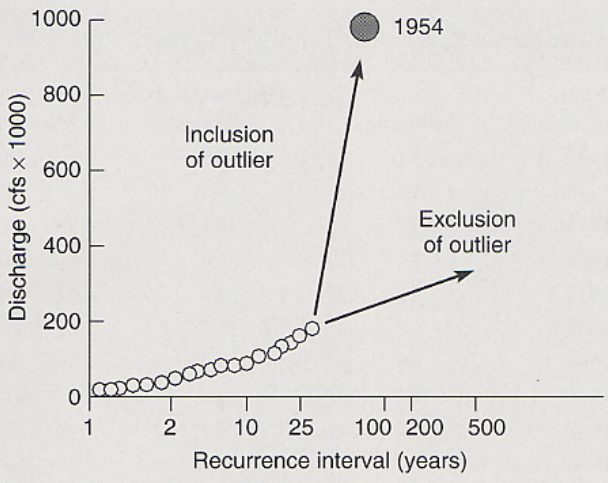


Figure 5.35
Flood frequency curve for the Pecos River near Langtry, Texas. Note the extreme outlier representing the 1954 flood and the problem for environmental planners of how to interpret this point.

Determinación de la frecuencia a diferentes escalas temporales: tipos de técnicas disponibles

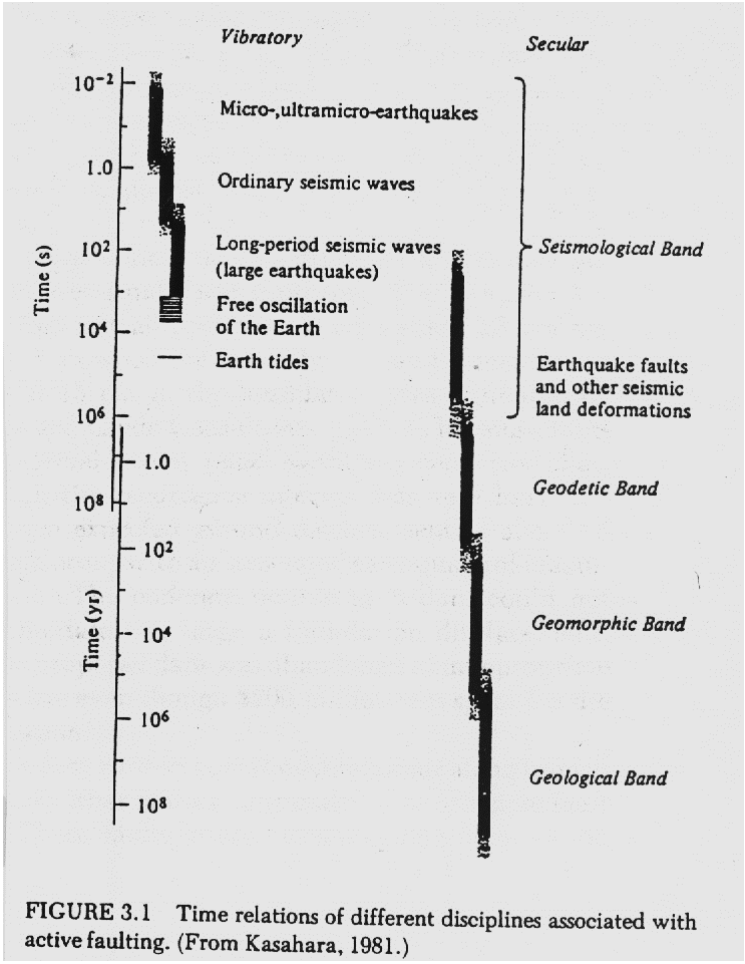


FIGURE 3.1 Time relations of different disciplines associated with active faulting. (From Kasahara, 1981.)

2.2. Tipos de edades y técnicas básicas de datación

Rosholt et al. 1991
"Dating methods applicable to the Quaternary"
The Geology of N. America. Vol K-2
Soc. Geol. America

TABLE 1. CLASSIFICATION OF QUATERNARY DATING METHODS*

Numerical-age
Calibrated Age
Relative-age
Correlated-age

Sidereal	Isotopic	Radiogenic	Chemical and Biochemical	Geomorphic	Correlation
Historical records	^{14}C	Uranium-trend	Amino acid racemization	Soil profile development	Stratigraphy
Dendrochronology	K-Ar and ^{39}Ar-^{40}Ar	Thermoluminescence OSL	Obsidian hydration	Rock and mineral weathering	Tephrochronology
Varve Chronology	Uranium-series†	Electron-spin resonance†	Tephra hydration	Rock varnish	Paleomagnetism
	Fission track	^{210}Pb	Lichenometry	Progressive land-form modification	Fossils and artifacts
		Other cosmo-genic isotopes	Soil chemistry	Rate of deposition	Stable isotopes
				Rate of deformation	Astronomical correlation
				Geomorphic position	Tectites and microtectites

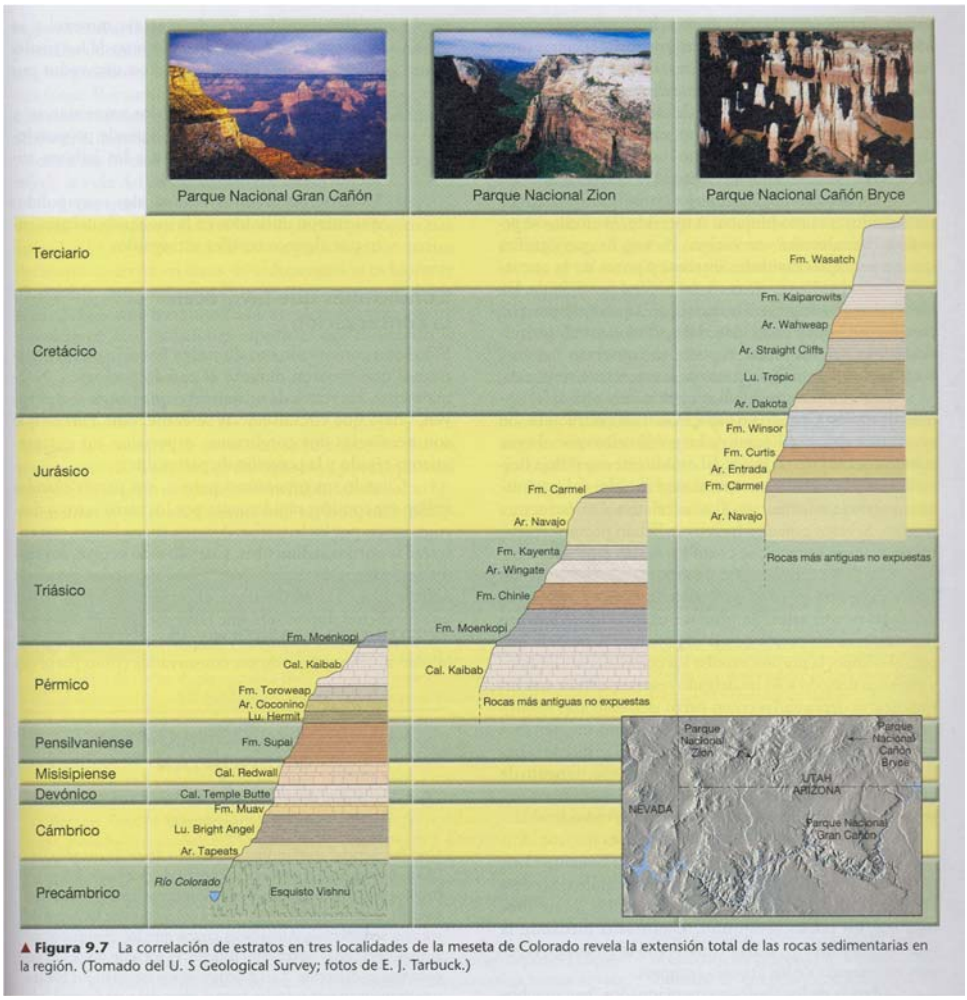
*Dashed line indicates the type of result most commonly produced by the methods below it; dotted line indicates the type of result less commonly produced by the methods below it.
†Methods above this line routinely produce numerical ages; methods below the line are more experimental and involve nonradioactive processes or processes whose effects on age estimates are not well established.

Datación absoluta (numérica): desintegración radiactiva

Radioactive Isotopes Commonly Used for Determining Ages of Rocks

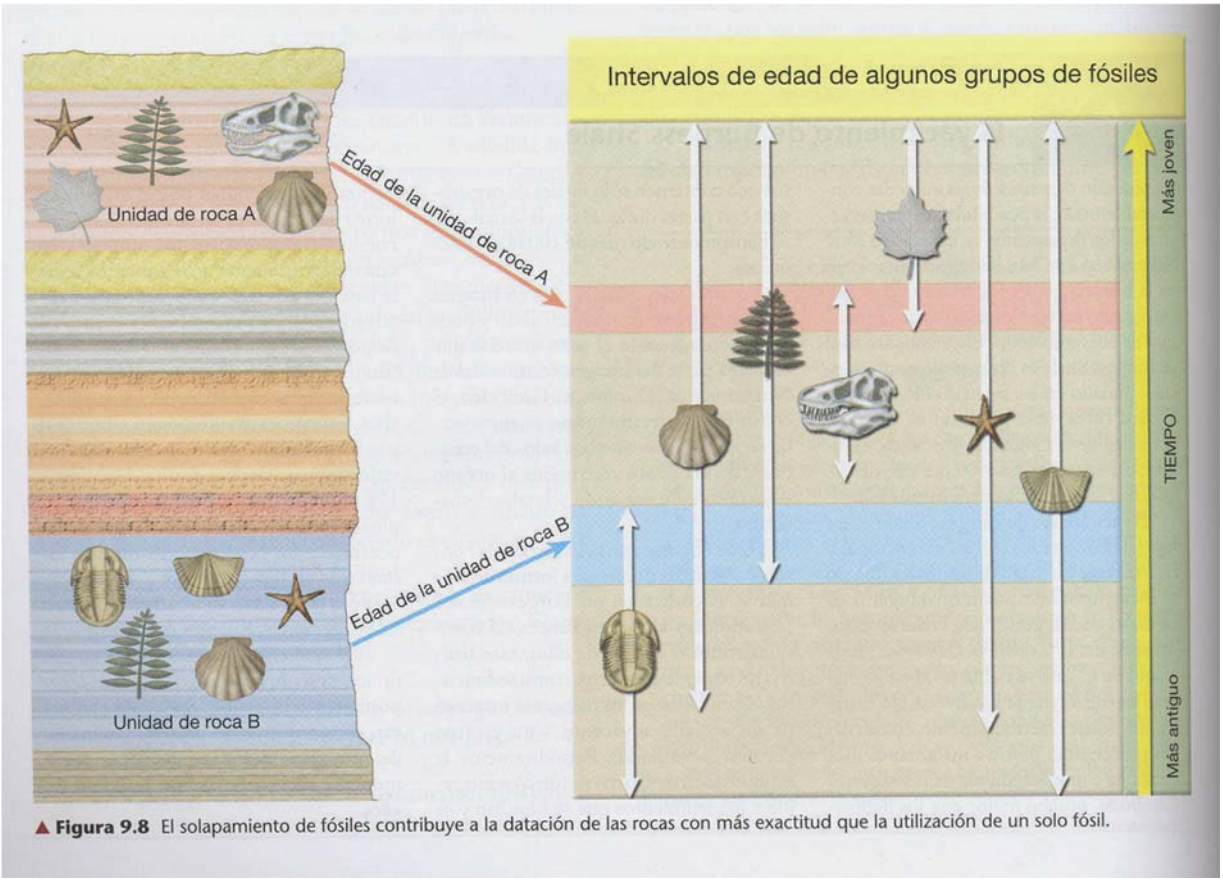
Isotope	Half-Life	Daughter Product
K-40	1.3 billion years	Ar-40
U-238	4.5 billion years	Pb-206
U-235	713 million years	Pb-207
Th-232	14.1 billion years	Pb-208
Rb-87	49 billion years	Sr-87
C-14	5,730 years	N-14

Principio de correlación estratigráfica



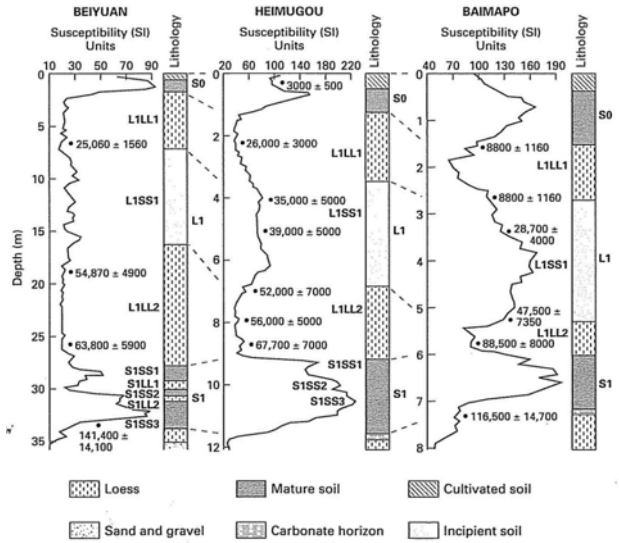
▲ **Figura 9.7** La correlación de estratos en tres localidades de la meseta de Colorado revela la extensión total de las rocas sedimentarias en la región. (Tomado del U. S Geological Survey; fotos de E. J. Tarbuck.)

Principio de sucesión paleontológica y correlación biostratigráfica



▲ **Figura 9.8** El solapamiento de fósiles contribuye a la datación de las rocas con más exactitud que la utilización de un solo fósil.

Correlación con paleomagnetismo



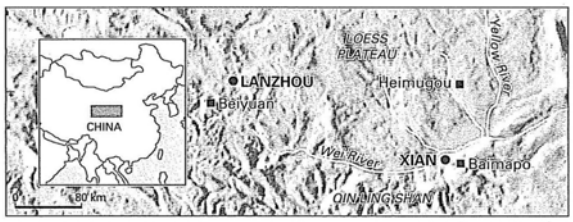


Figure 5.27 Magnetic susceptibility profiles through three loess sequences in China covering the last 130 ka. The chronology is based on TL dating. Location of profiles is shown on inset map (after An *et al.*, 1991).

Correlación con $\delta^{18}O$

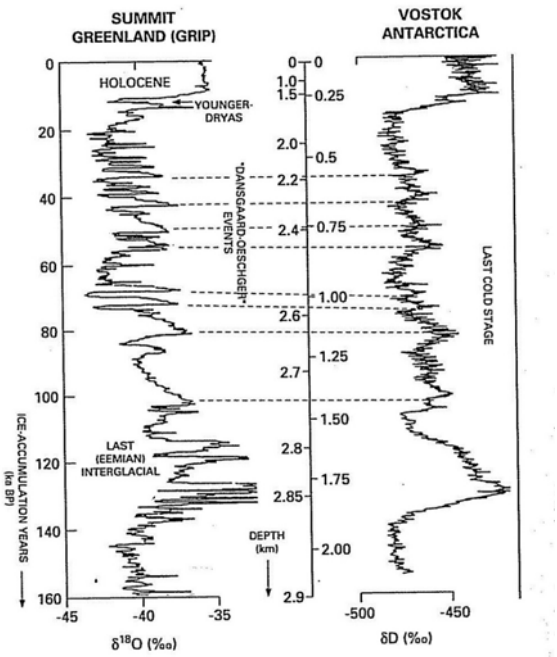


Figure 3.50 Stable isotope variations during the last 160 ka recorded in the GRIP Greenland Summit core (oxygen isotopes) and the Vostok core from Antarctica (deuterium ratios). Note that the vertical scale is in ice-accumulation years; conversion to a depth scale would lead to a marked transformation of the plots, since the Holocene sequence in both cores is much thicker than older parts of the sequence (modified from Peel, 1994).

2.3. Principios de datación relativa

- **Principio de superposición estratigráfica**
- **Principio de intersección**
- **Principio de escalonamiento geomorfológico**

Ejercicio 1: datación relativa de depósitos glaciales y glacio-fluviales

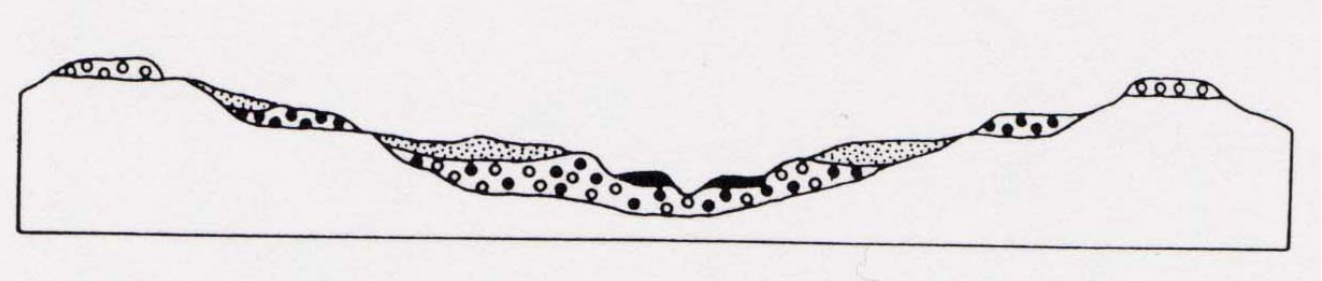
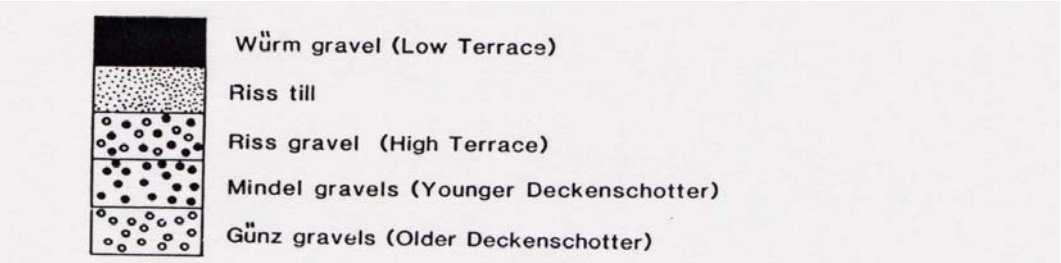


Fig. 1.5 — Schematic section through a Swiss valley, showing sequence of gravel terraces deposited during successive cold stages with intervening episodes of down-cutting (from Heim 1919).



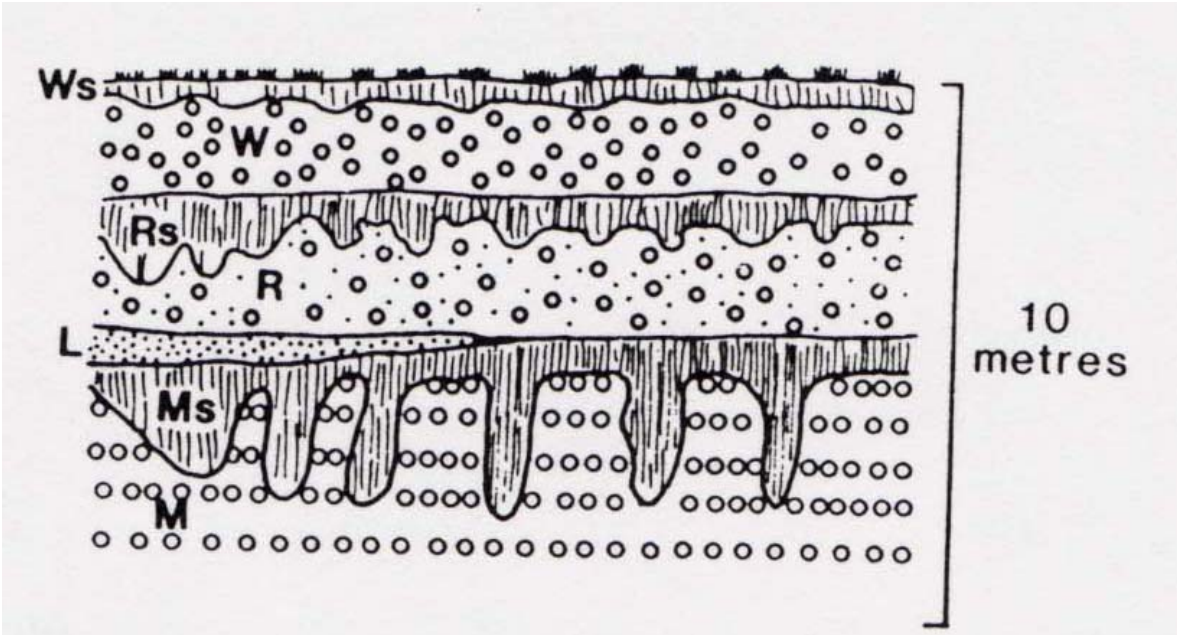


Fig. 1.6 — Section south of Munich, S. Germany, showing three glacial gravels with intervening soils (from Penck and Brückner 1909). W=Würm, R=Riss, M=Mindel, subscript s denotes soil developed on each gravel, L= loess.

2.4. Datación de depósitos y datación de superficies

Datación de procesos con:

- **Depósitos asociados (sólo procesos que generan sedimentos nuevos)**
- **Formas (superficies) asociadas (isótopos in situ y técnicas botánicas)**

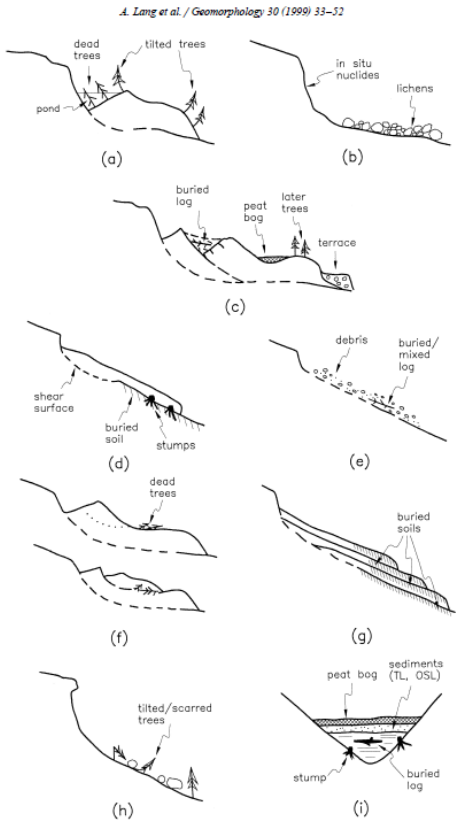


Fig. 3. Location of datable elements relative to the landslide body (see explanations in the text).

Diacronía de depósitos y unidades estratigráficas

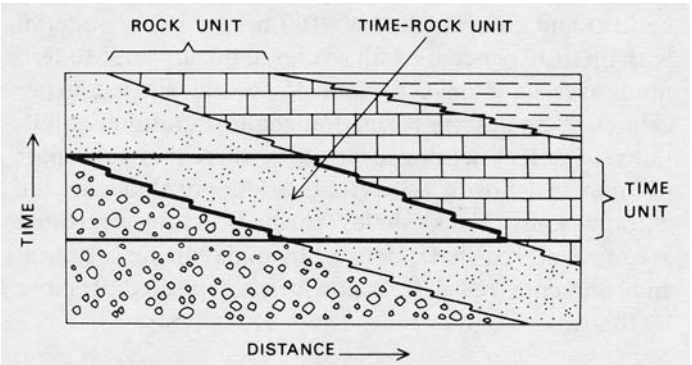


Figure 4.16 Schematic diagram illustrating the distinction between rock units, time units and time-rock units.

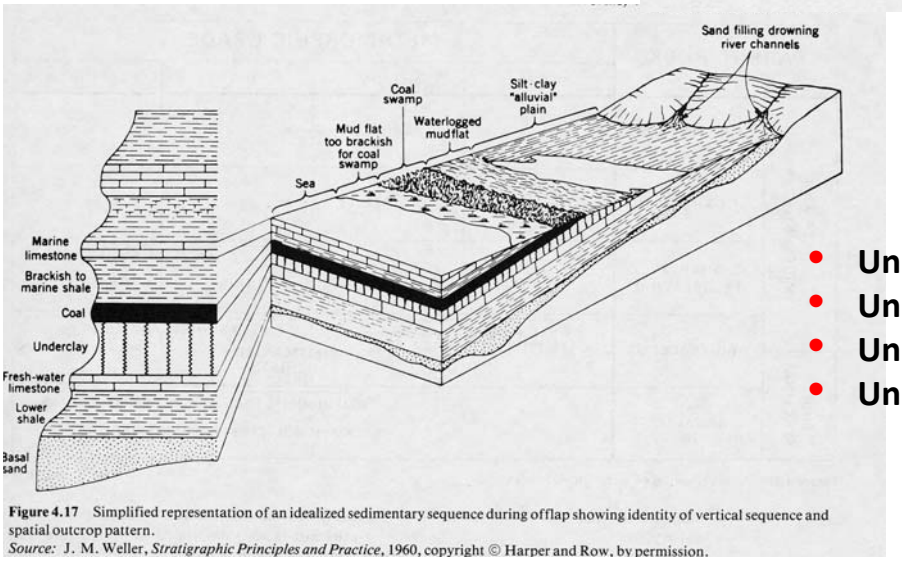


Figure 4.17 Simplified representation of an idealized sedimentary sequence during offlap showing identity of vertical sequence and spatial outcrop pattern.
Source: J. M. Weller, *Stratigraphic Principles and Practice*, 1960, copyright © Harper and Row, by permission.

- **Unidades deposicionales**
- **Unidades litostratigráficas**
- **Unidades morfostratigráficas**
- **Unidades cronostratigráficas**