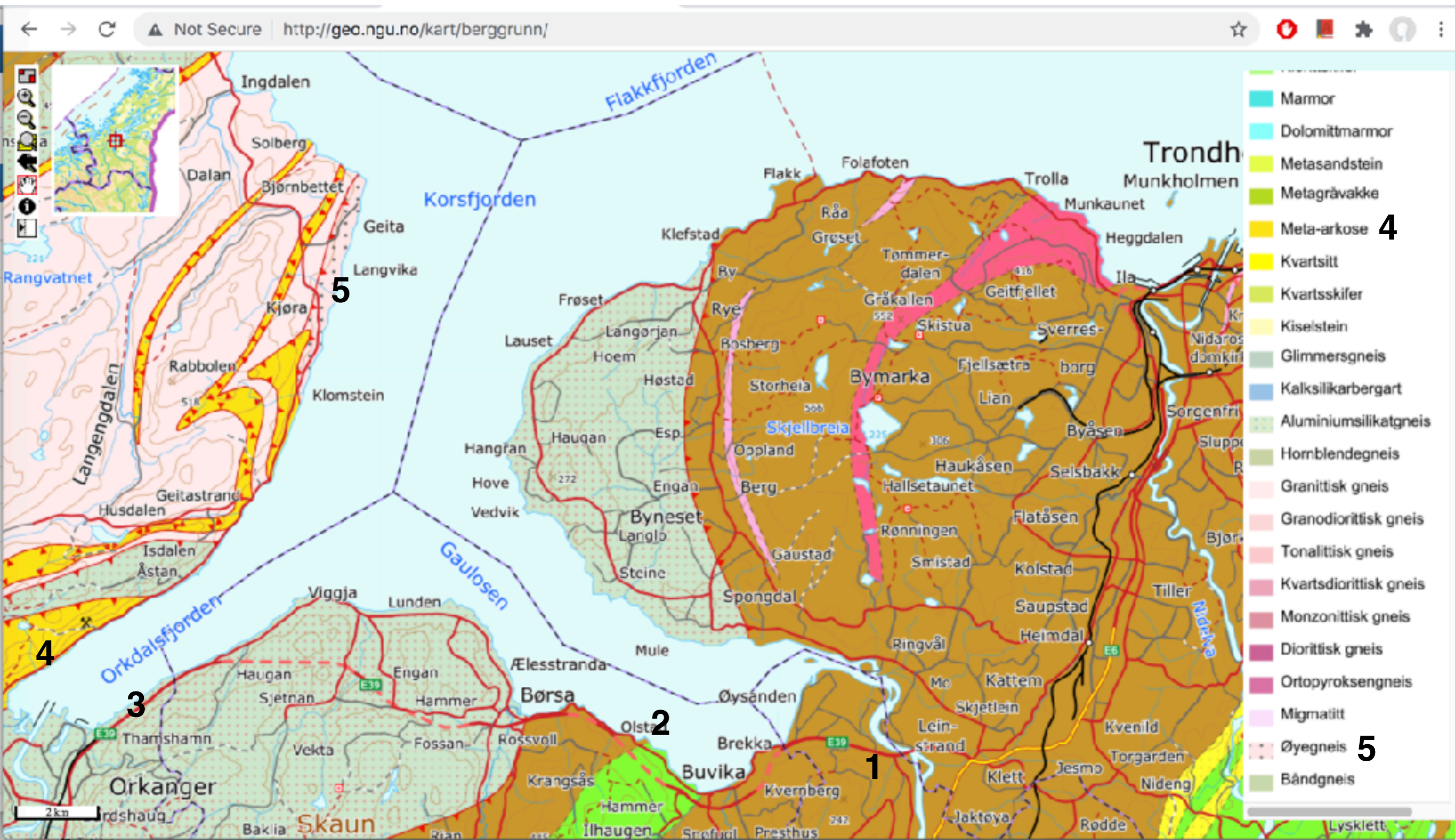


# NGU 1: 250 000 kartserie





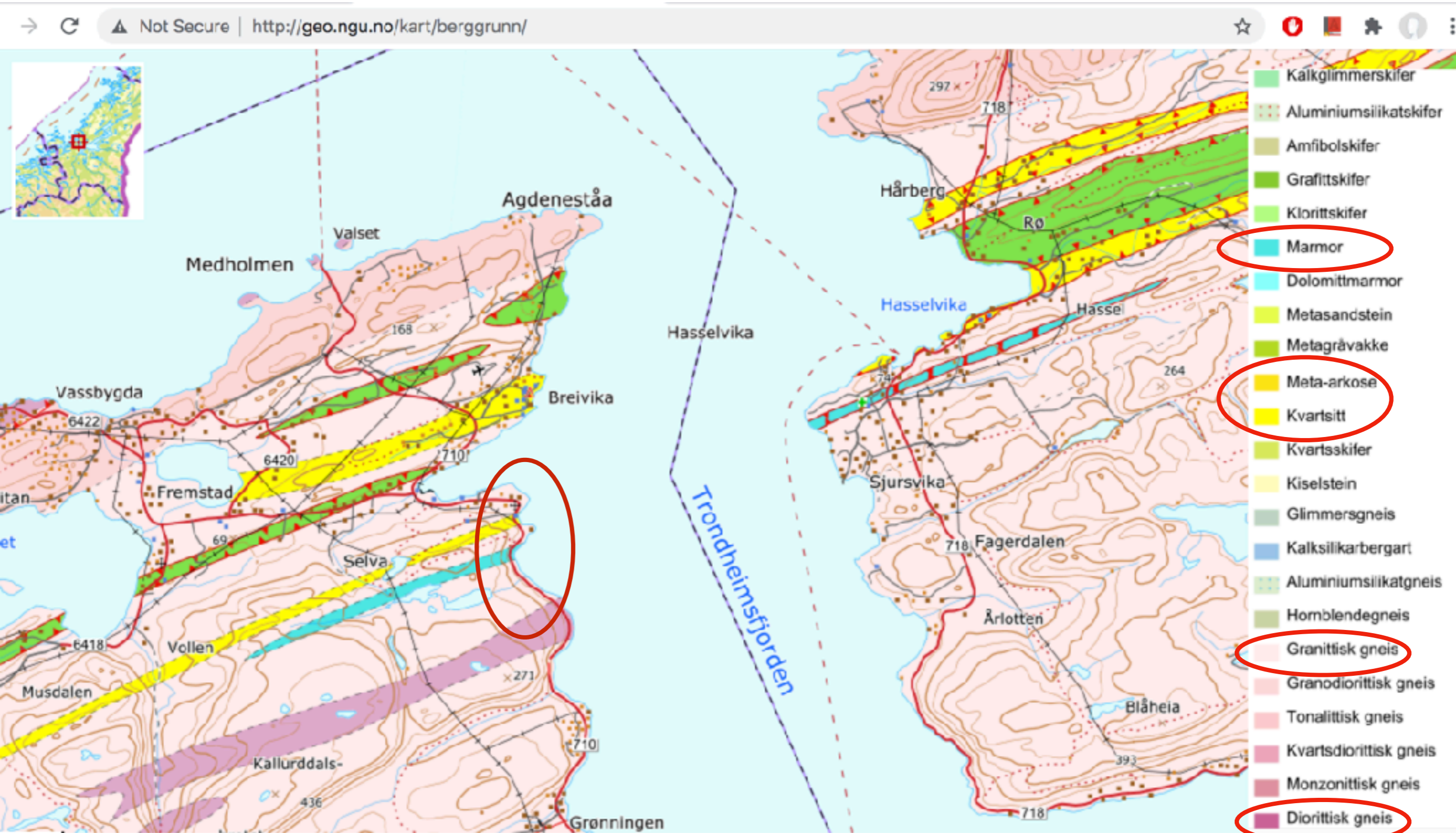
# Aker Brygge, Oslo



[Google images av Rapakivi Granitt](#)

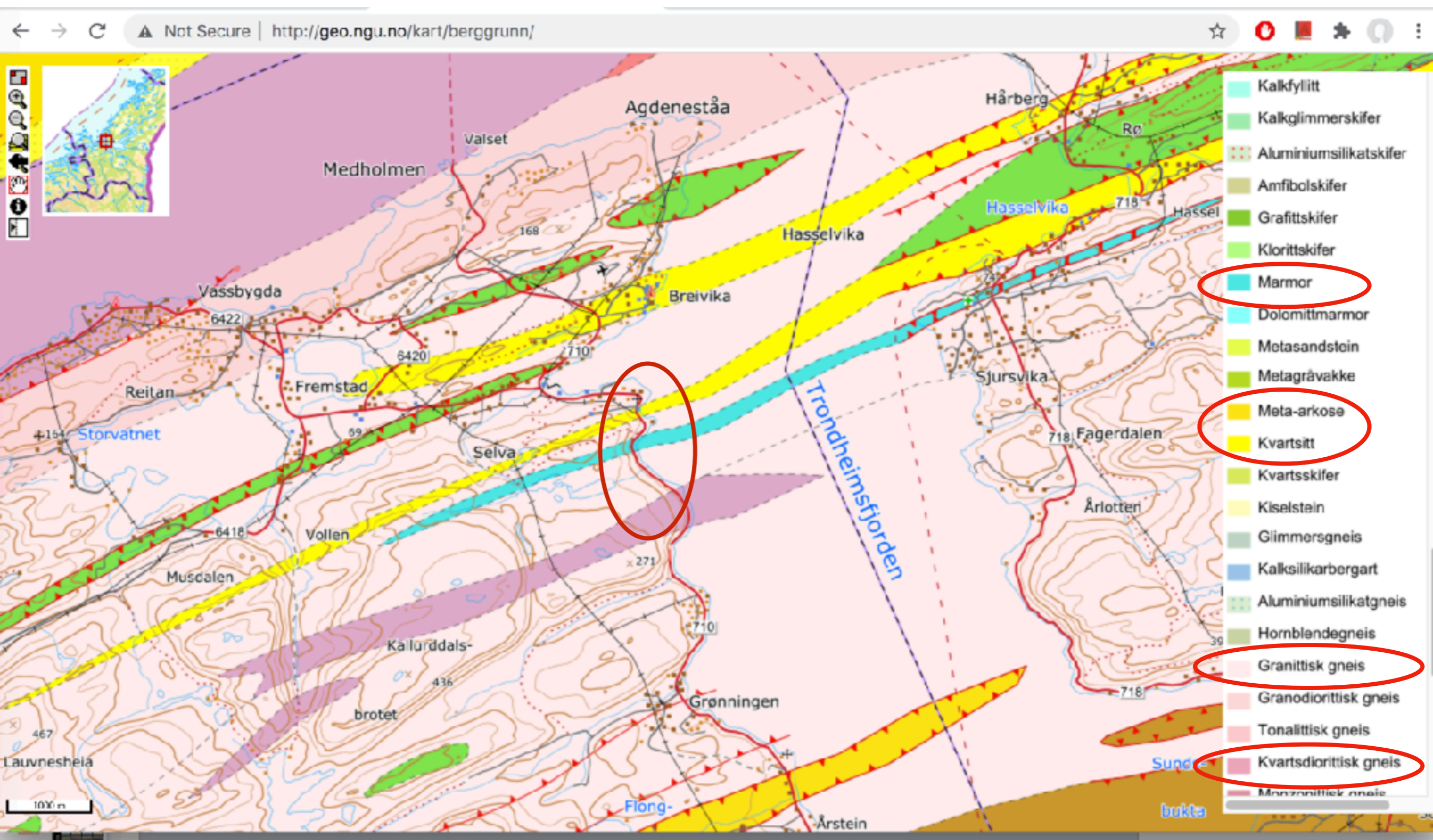


# NGU 1: 250 000 kartserie





# NGU 1: 250 000 kartserie





## NGU 1: 50 000 kartserie (mer detaljert)

klikk på ( i ) →  
for en  
beskrivelse  
av hver  
enkel bergart





**TABLE 7.1** Relative Stability of Minerals at the Earth's Surface

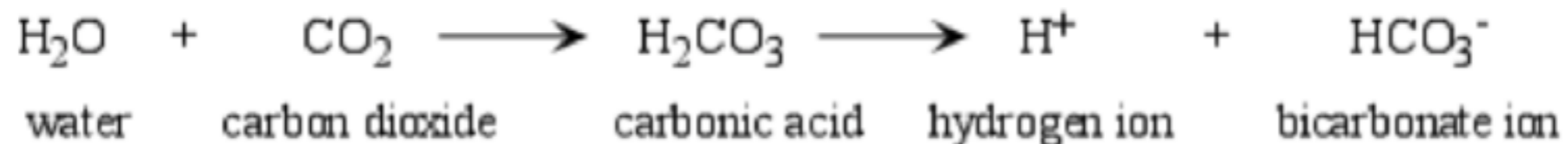
Fastest Weathering		Least Stable
	Halite	
	Calcite	
	Olivine	
	Ca-plagioclase	
	Pyroxene	
	Amphibole	
	Na-plagioclase	
	Biotite	
	Orthoclase (potassium feldspar)	
	Muscovite	
	Clay (various types)	
	Quartz	
	Gibbsite (aluminum hydroxide)	
	Slowest Weathering	

Note that minerals that form early in Bowen's reaction series (see Box 6.2) are among the least stable minerals at the Earth's surface. Minerals that are the products of weathering reactions (e.g., hematite) are among the most stable minerals at the Earth's surface. Mafic minerals weather by oxidation, felsic minerals by hydrolysis, carbonates and salts by dissolution, and oxide minerals don't weather at all.



The main agent responsible for chemical weathering reactions is water and weak acids formed in water.

- An acid is solution that has abundant free  $H^+$  ions.
- The most common weak acid that occurs in surface waters is carbonic acid.  
**karbonsyre**
- Carbonic acid is produced in rainwater by reaction of the water with carbon dioxide ( $CO_2$ ) gas in the atmosphere.



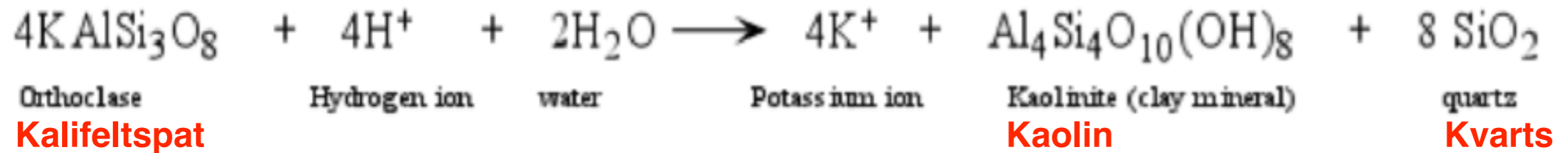
$H^+$  **(en liten ion)** is a small ion and can easily enter crystal structures, releasing other ions into the water.



## Types of Chemical Weathering Reactions

- **Oppløsning** -  $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$

- **Hydrolysis** -  $\text{H}^+$  or  $\text{OH}^-$  replaces an ion in the mineral. Example:

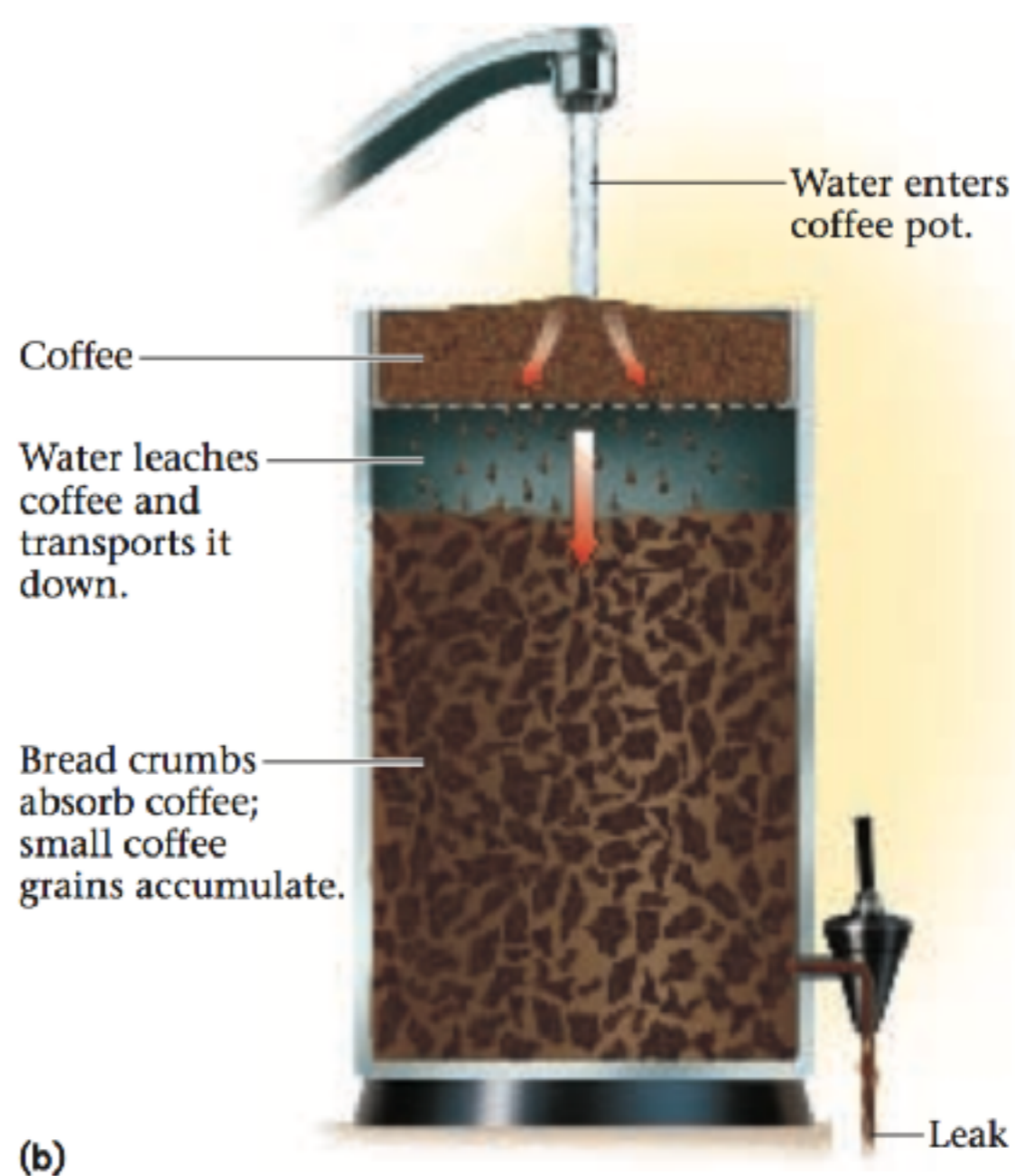
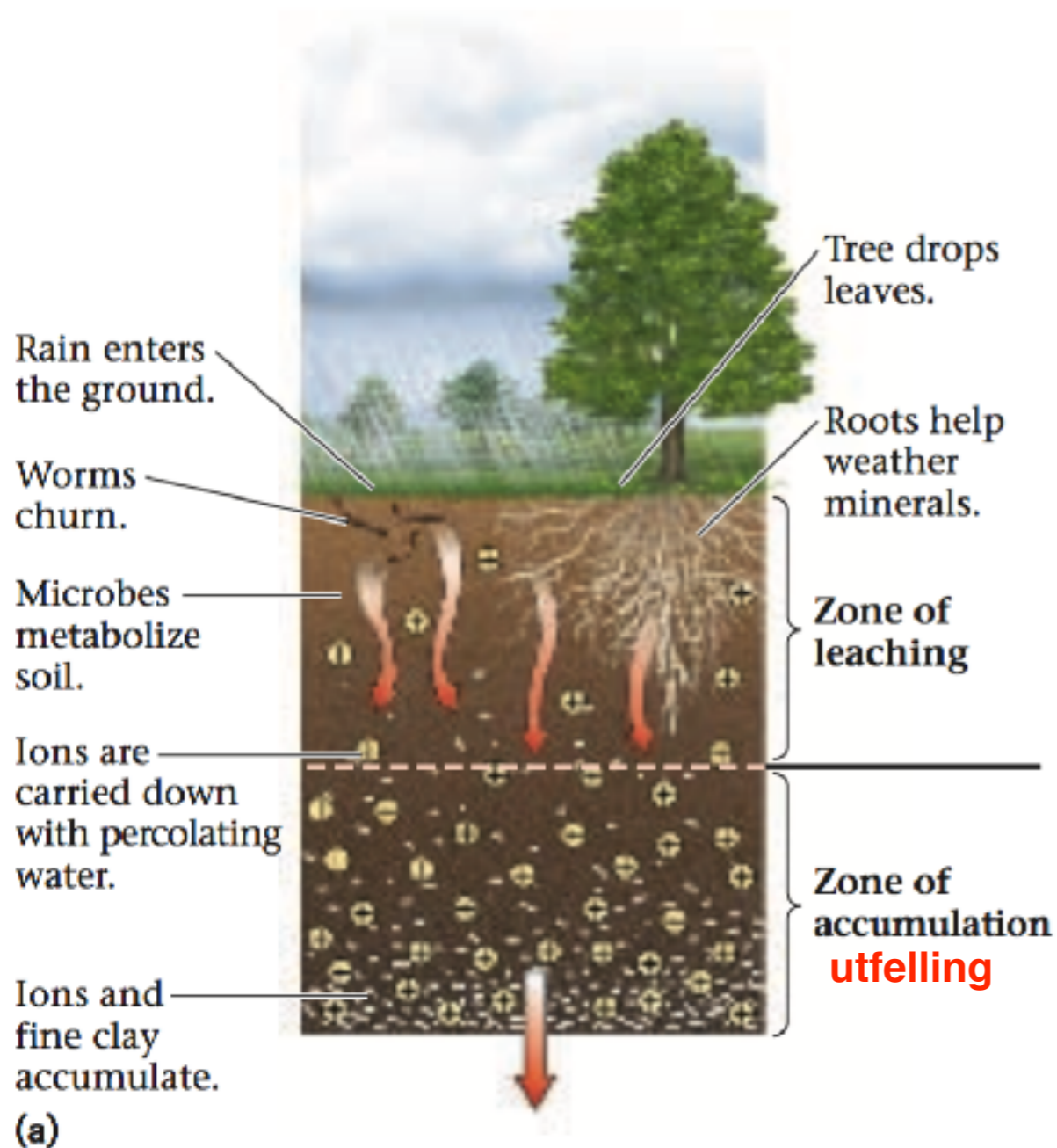


- **Leaching** - ions are removed by dissolution into water. In the example above we say that the  $\text{K}^+$  ion was leached.  
**Utløsing**

- **Oxidation** - Since free oxygen ( $\text{O}_2$ ) is more common near the Earth's surface, it may react with minerals to change the oxidation state of an ion. This is more common in Fe  
**Oksidering**

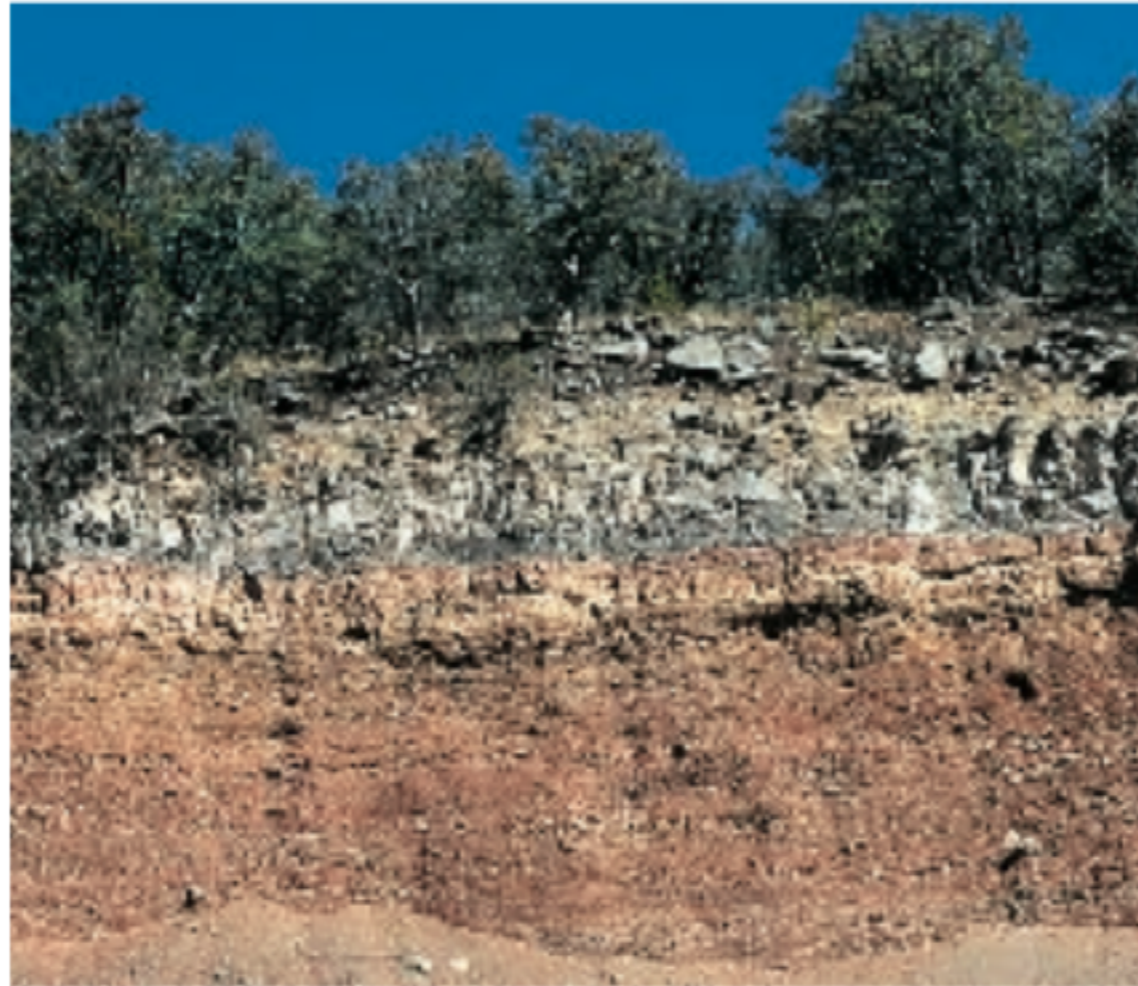


**FIGURE 7.12** During the formation of soil, the downward percolation of water creates a zone of leaching and a zone of accumulation. **(a)** In soil, the percolating water carries ions and clay downward. Soil formation also involves the metabolism of microbes and fungi and the addition of organic matter at the surface and underground. **(b)** The same process happens when you pour hot water through coffee grounds or tea leaves into a pot containing bread crumbs. Elements in the coffee or tea dissolve in the water and are carried down and collect in the bread crumbs; coffee eventually leaks from the pot.



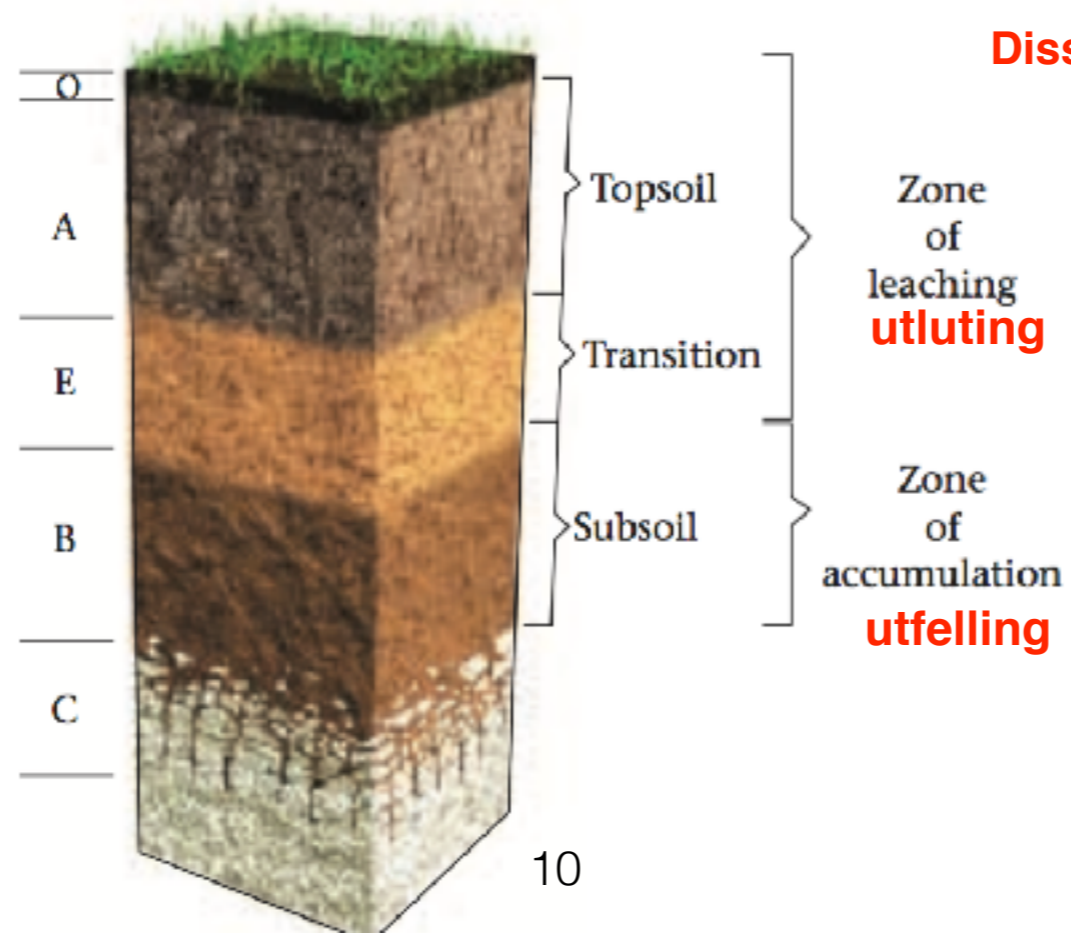
**Kaffetrakter modell.  
Veldig god modell for jordsmonn.**



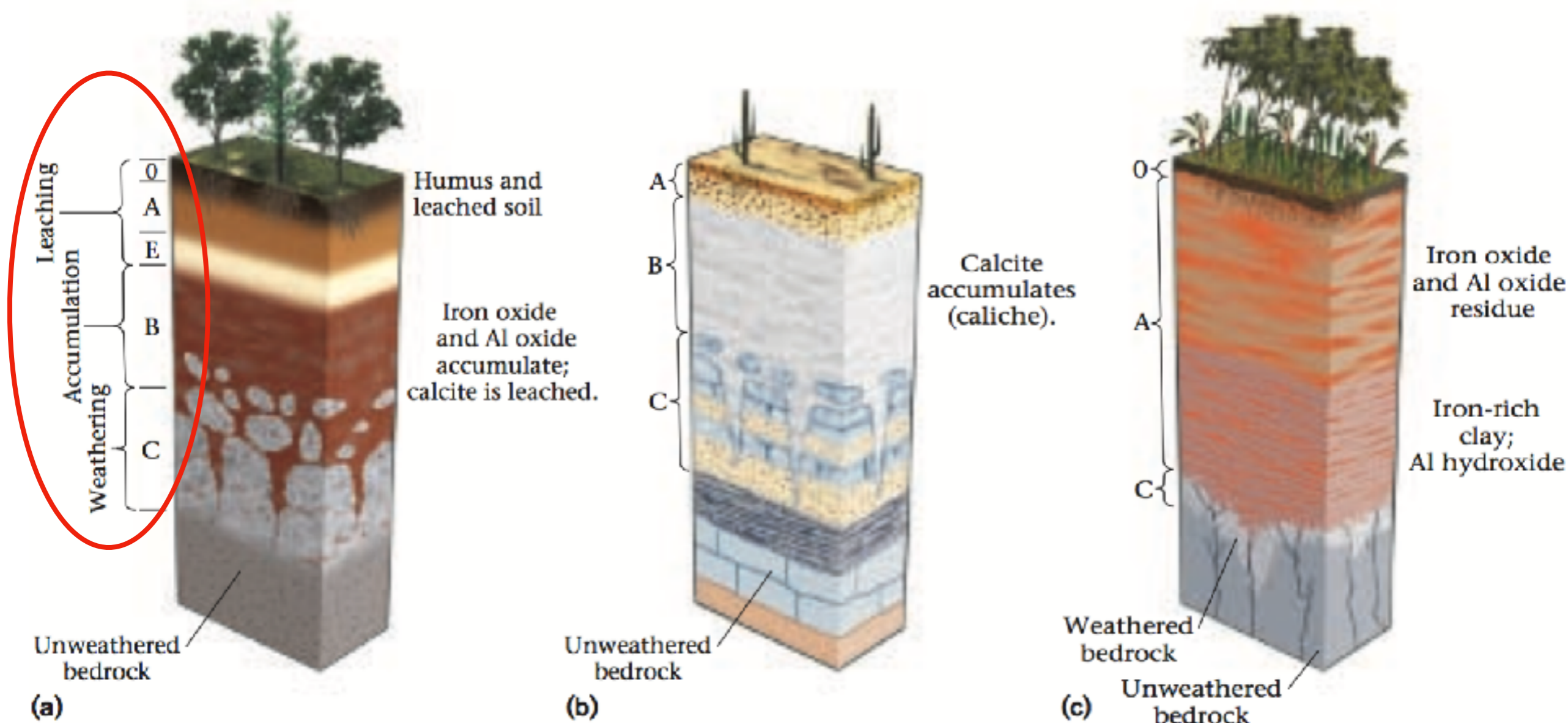


## jordsmonn (soil)

Disse ulike fargene er ikke opprinnelige.  
Bergarten var ikke lagdelt.







## Ulike typer jordsmonn, og jordsmonnprofiler

(Det finnes kanskje hundre ulike typer jordsmonn, og alle har vitenskapelige navn)

De fleste har noen slags O lag, A lag, B lag, C lag

(O står for 'organisk')

kanskje hundre ulike typer jordsmonn

Ulike typer jordsmonn, og jordsmonnprofiler (ikke pensum for oss!)

# THE 12 ORDERS OF SOIL TAXONOMY

United States Department of Agriculture



**ALFISOLS**  
Which are in temperate moist areas. These soils result from weathering processes that leach the nutrients and other substances out of the surface layer and into the subsoil, where they can be held and supply nutrients and moisture to plants. They formed primarily under forest or other vegetation cover and are productive for most crops.  
Average water of about 10% of the world's arable land surface.



**ANDISOLS**  
Andisols form from weathering processes that generate silicates and other acidic minerals. These minerals can hold an unusually high water and nutrient holding capacity. In a sense, Andisols react to be highly productive soils. They include nearly unweathered soils with much volcanic glass as well as more strongly weathered soils. They are common in moist areas with moderate to high precipitation, especially those areas associated with wet-temperate climates.  
Average water of about 1% of the world's arable land surface.



**ARIDISOLS**  
Andisols are soils that are best for the growth of arid-tolerant plants. The lack of moisture greatly restricts the intensity of weathering processes and limits soil development processes in the upper part of the soil. Andisols often weather rapidly, with calcium carbonate, and other materials that are easily leached from soils in these humid environments.  
Andisols are common in the deserts of the world.  
Average water of about 12% of the world's arable land surface.



**ENTISOLS**  
Entisols are soils that show little or no evidence of pedogenic feature development. Entisols occur in areas of relatively frequent ground moisture or in areas where erosion or deposition rates are faster than the rate of soil development, such as dunes, steep slopes, and flood plains. They occur in many environments.  
Entisols cover about 10% of the world's arable land surface.



**GELISOLS**  
Gelisols are soils that have permafrost near the soil surface and/or have evidence of permafrost from changing water ice segregation.  
Gelisols are common in the higher latitudes or at high altitudes.  
Gelisols cover about 1% of the world's arable land surface.



**HISTOSOLS**  
Histosols have a high content of organic matter and are primarily from an undecomposed plant matter. Soils are highly drained. Histosols are commonly called bogs, mires, peats, or marshes. Histosols form in decomposed plant remains that accumulate in water, bogs, or other areas that they decay. If these soils are drained and exposed to air, microbial decomposition is accelerated and the soils may oxidize dramatically.  
Histosols cover about 1% of the world's arable land surface.



**INCEPTISOLS**  
Inceptisols are soils of somewhat to humid environments that generally exhibit only moderate degrees of soil weathering and development.  
Inceptisols have a wide range of textures and are most common in a wide variety of climates.  
Inceptisols cover about 8% of the world's arable land surface.



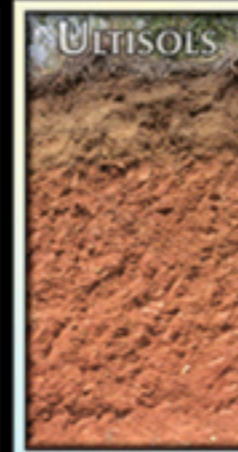
**MOLLISOLS**  
Mollisols are soils that have a dark colored surface horizon relatively high in content of organic matter. The soils are free with throughout and therefore are highly fertile.  
Mollisols characteristically form under grass in climates that have a moderate to continental amount of moisture. Mollisols are common soils on the steppes of Europe, Asia, North America, and South America.  
Mollisols cover about 7% of the world's arable land surface.



**OXISOLS**  
Oxisols are highly weathered soils of tropical and subtropical regions. They are dominated by iron-oxides, such as goethite, hematite, and iron-crocidolite. They tend to have reddish horizons.  
Oxisols characteristically occur on level surfaces that have been stable for a long time. They have low natural fertility as well as a low capacity to retain additional nitrate and potassium.  
Oxisols cover about 8% of the world's arable land surface.



**SPODOSOLS**  
Spodosols formed from weathering processes that strip organic matter and nutrients with aluminum ions or silicon ions from the surface layer and deposit them in the subsoil. In undisturbed areas, a gray mineral horizon that has the color of unweathered quartz underlies a reddish brown or black subsoil.  
Spodosols commonly occur in areas of temperate forested regions under conditions of humid climates.  
Spodosols cover about 4% of the world's arable land surface.



**ULTISOLS**  
Ultisols are soils in humid areas. They formed from both weathering and leaching processes that result in a clay-enriched subsoil dominated by minerals, such as quartz, kaolinite, and iron oxides.  
Ultisols are typically acid soils in which base cations are concentrated in the upper few inches. They have a moderate to low capacity to retain additional nitrate and potassium.  
Ultisols cover about 8% of the world's arable land surface.



**VERTISOLS**  
Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture. They have cracks that open and close periodically, and that show evidence of soil movement in the profile.  
Because they swell when wet, vertisols expand under water stress and have undergone little leaching. They tend to be fairly high in nutrient levels.  
Vertisols cover about 2% of the world's arable land surface.



## Weathering of Common Rocks

### restmineraler

### utluttet ioner

Rock	Primary Minerals	Residual Minerals* kaffegrut	Leached Ions kaffe
Granite	Feldspars som kaffepulver	Clay Minerals kaffe grut	$\text{Na}^+$ , $\text{K}^+$
	Micas som litt fuktig kaffepulver	Clay Minerals	$\text{K}^+$
	Quartz som sand i kaffe-trakter modell	Quartz (endres ikke)	---
	Fe-Mg Minerals som jern spiker	Clay Minerals + Hematite + Goethite rusten spiker	$\text{Mg}^{+2}$
Basalt	Feldspars	Clay Minerals	$\text{Na}^+$ , $\text{Ca}^{+2}$
	Fe-Mg Minerals	Clay Minerals	$\text{Mg}^{+2}$
	Magnetite	Hematite, Goethite	---
Limestone	Calcite som sukker eller saltkorn	None (oppløses fullstendig)	$\text{Ca}^{+2}$ , $\text{CO}_3^{-2}$ $\text{CO}_2?$

\*Residual Minerals = Minerals stable at the Earth's surface and left in the rock after weathering.

**Weathering of Common Rocks****restminerale****utluttet ioner**

Rock	Primary Minerals	Residual Minerals*	Leached Ions
Granite	Feldspars	Clay Minerals (Al <sup>+</sup> blir igjen i leire)	Na <sup>+</sup> , K <sup>+</sup>
	Micas	Clay Minerals (Al <sup>+</sup> blir igjen i leire)	K <sup>+</sup>
	Quartz	Quartz (endres ikke)	---
	Fe-Mg Minerals	Clay Minerals + Hematite + Goethite	Mg <sup>+2</sup>
Basalt	Feldspars	Clay Minerals (Al <sup>+</sup> blir igjen i leire)	Na <sup>+</sup> , Ca <sup>+2</sup>
	Fe-Mg Minerals	Clay Minerals (Al <sup>+</sup> blir igjen i leire)	Mg <sup>+2</sup>
	Magnetite	Hematite, Goethite	---
Limestone	Calcite	None (oppløses fullstendig)	Ca <sup>+2</sup> , CO <sub>3</sub> <sup>-2</sup>

\*Residual Minerals = Minerals stable at the Earth's surface and left in the rock after weathering.

Det er Leire som brukes for å utvinne aluminiumsmetall.

Al-rik leire fra tropiske land fraktes til Norge, der det brukes norsk hydroelektrisk strøm til å fjerne oksygen og vann og lage metallisk aluminium, som eksporteres. Det er en måte å eksportere norsk hydroelektrisk strømenergi.



Det er Leire som brukes for å utvinne aluminiumsmetall.

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Sunndalsøra aluminium

All Images Videos News Maps

All Regions ▾ Safe Search: Moderate ▾ All Sizes ▾ All Types ▾ All Layouts ▾ /



Sunndal aluminium plant | Norsk Hydr...  
flickr.com

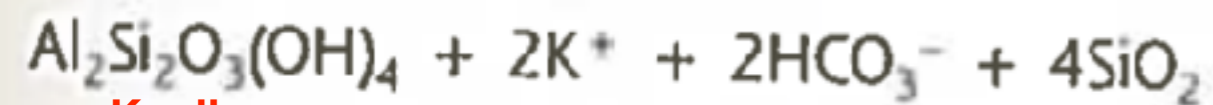


Hydro Aluminium, Sunndalsøra | Mannvit  
mannvit.no

ionet ( $H^+$ ) angriper direkte det krystalline nettverket i silikatmineralene og omdanner dem til leirmineraler, for eksempel kaolinitt. Denne kjemiske omdannelsen av silikatmineraler, for eksempel ortoklas ( $KAlSi_3O_8$ ) til leirmineraler, kan illustreres i denne kjemiske reaksjonslikningen:



Kalifeltspat

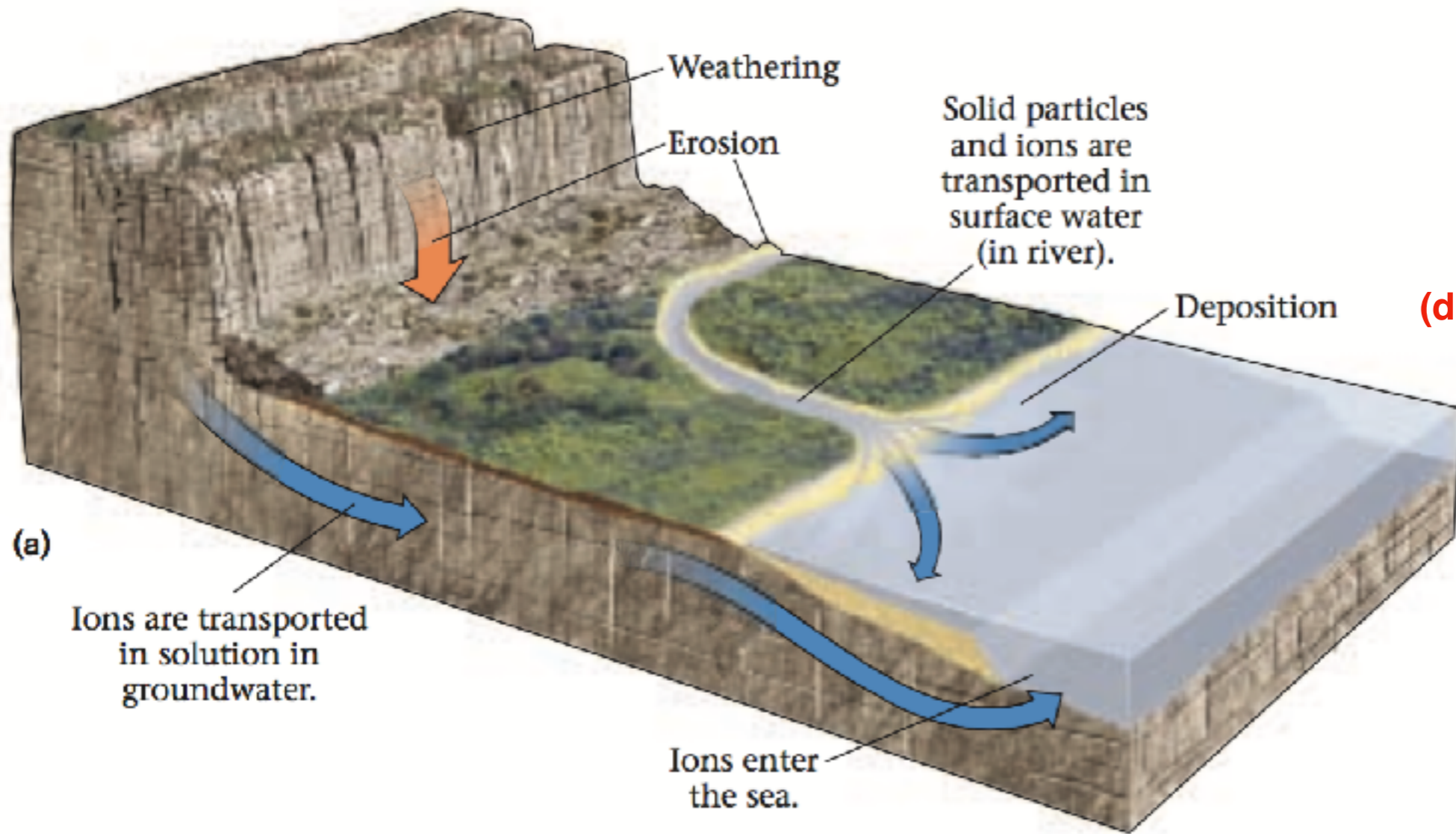


Kaolin

De dannede kaolinmineralene ( $Al_2Si_2O_5(OH)_4$ ) inngår i bergarten som blir igjen, mens kaliumionet ( $K^+$ ) sammen med oppløst  $SiO_2$  kan føres bort med grunnvannet. Kalium inngår som næringsstoff for planter, mens oppløst  $SiO_2$  andre steder kan danne bekkenes fyllstoff.

Se hvor mye Al det er i Kaolin. Kaolin er som kaffegrut.



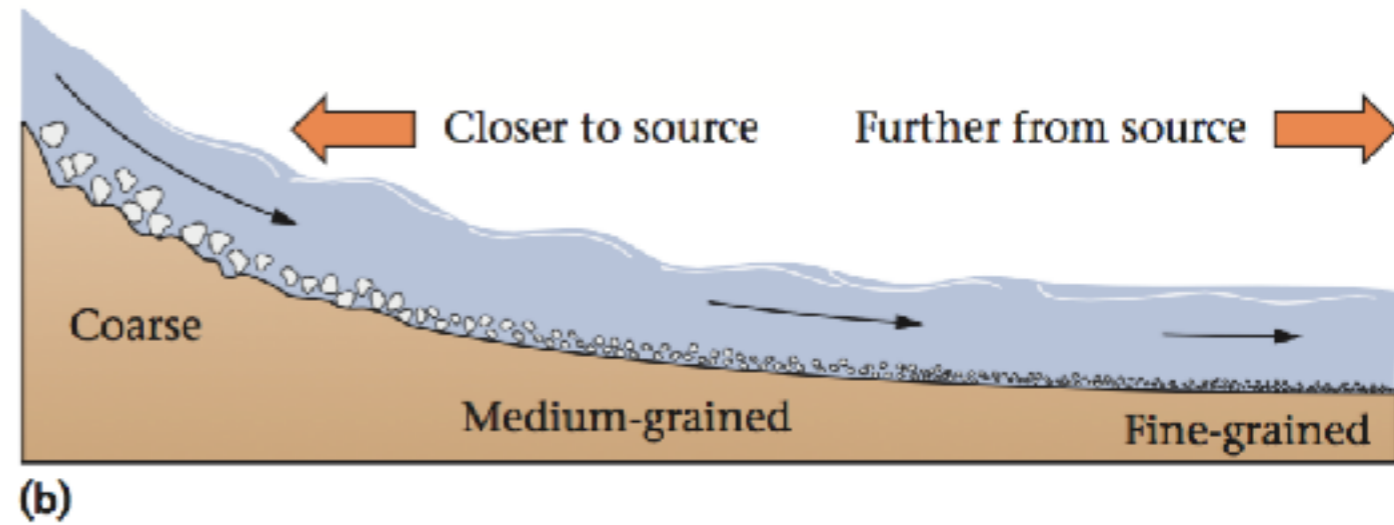


*nøkkelord:*

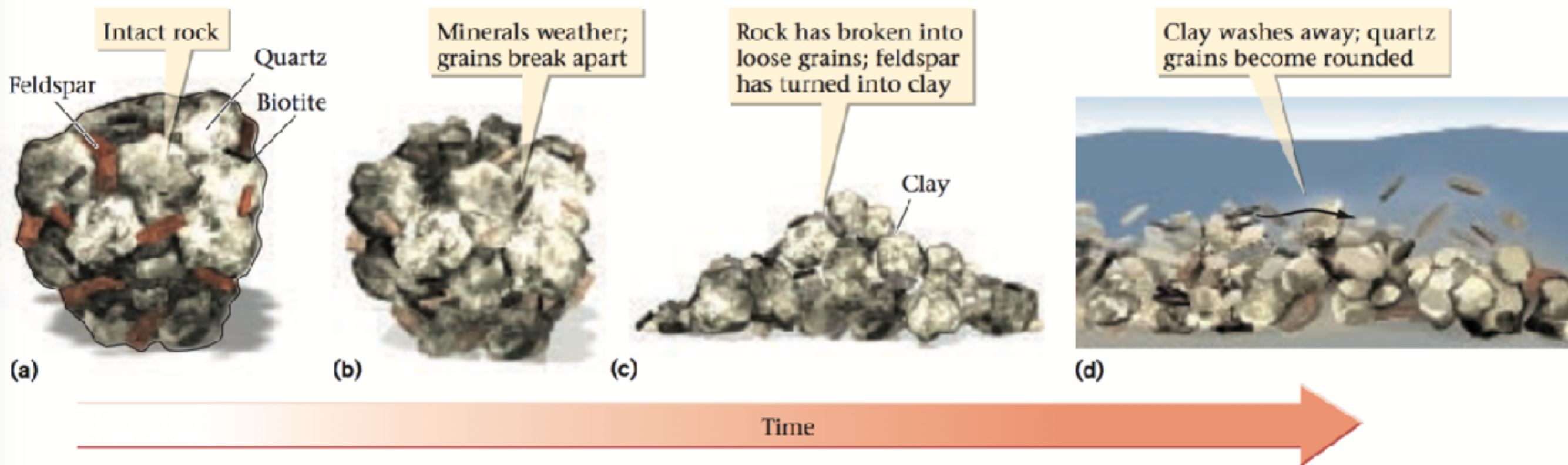
**forvitring  
transport  
(disse 2 utgjør erosjon)**

**avsetning  
overleiring  
kompaksjon  
sementering  
litifisering**

**FIGURE 7.16 (a)** The basic steps during the development of a sedimentary rock: weathering → erosion → transportation → deposition → lithification. **(b)** As sediment moves from its source to the site of deposition, it becomes finer grained.

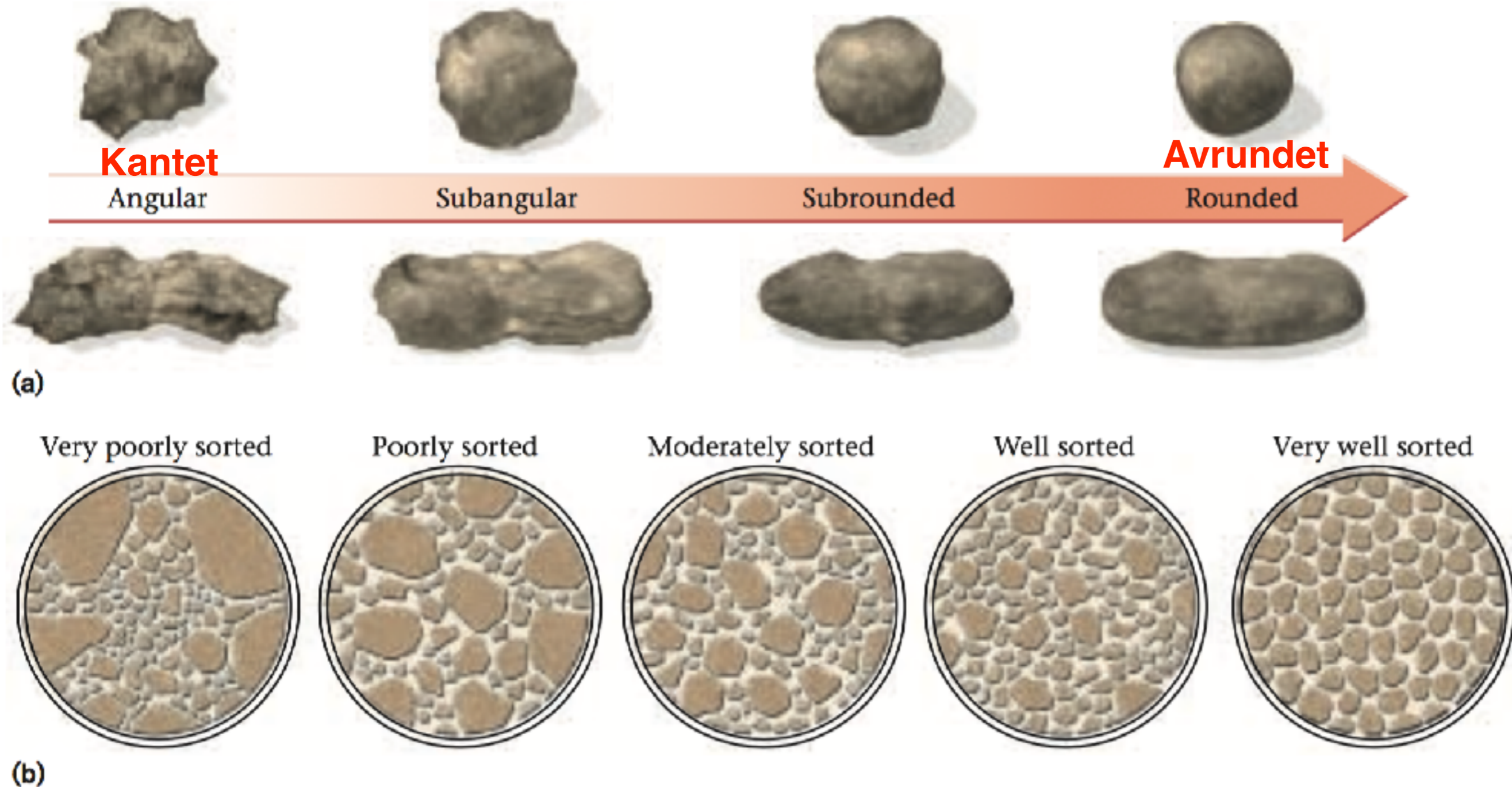


**FIGURE 7.9** Chemical weathering aids physical weathering by weakening the attachments between grains. **(a)** This rock is solid. **(b)** Susceptible minerals have started to weather. **(c)** The rock crumbles. **(d)** Weaker minerals break up or react to form clay and wash away.



**Hvis kjemisk forvitring er betydelig, blir den opprinnelige kornstørrelsen avgjørende for sediment kornstørrelser. Fordi mineralene faller fra hverandre helt fra starten.**





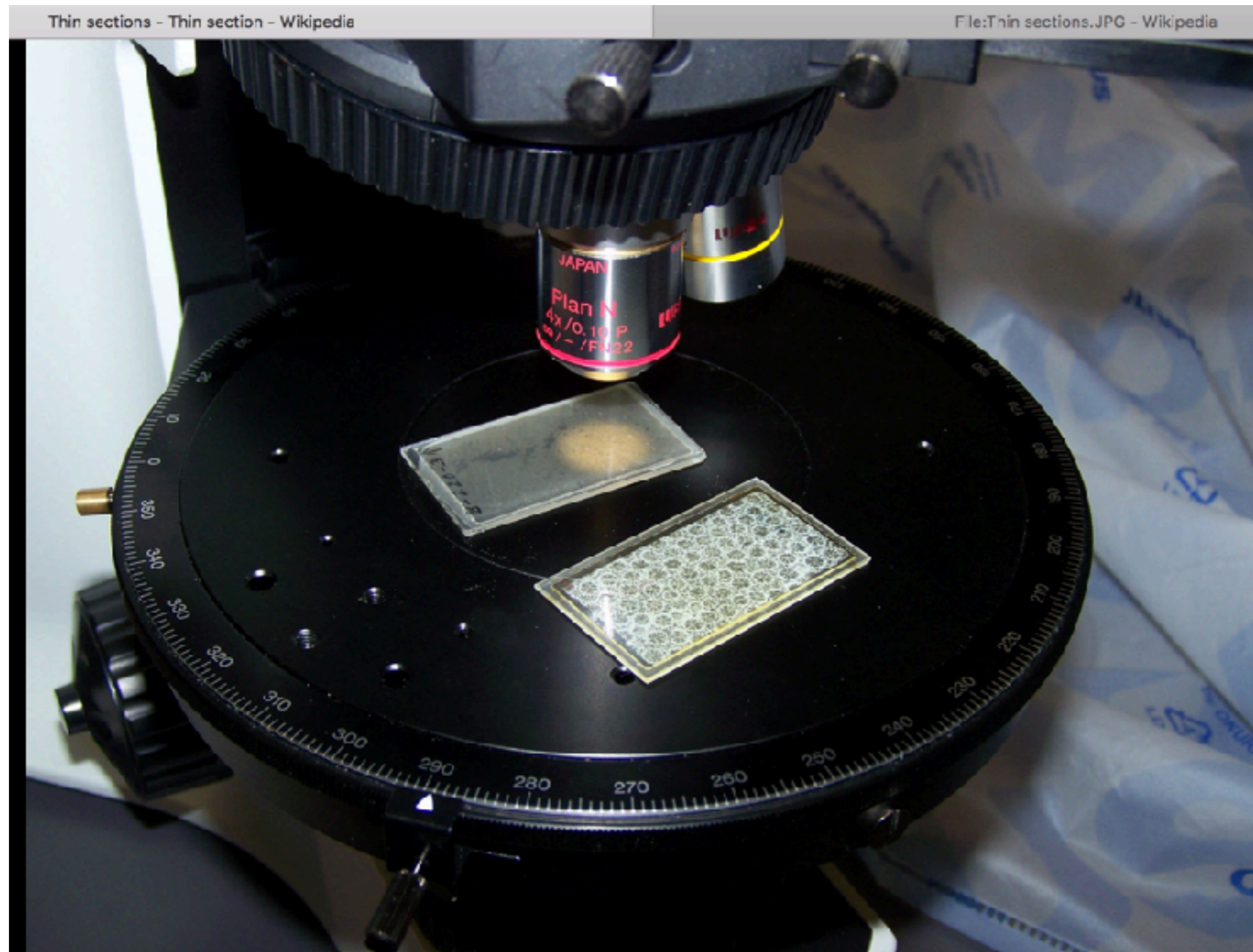
**FIGURE 7.18** (a) A grain with high sphericity (top row) has roughly the same length in all directions, whereas one with low sphericity is elongate or flattened (bottom row). Sphericity is independent of angularity, which refers to whether the grain has sharp corners or edges or not. Grains on the left are more angular than grains on the right. (b) In a poorly sorted sediment, there is a great variety of different clast sizes, whereas in a well-sorted sediment, all the clasts are the same size.

**Alle mineraler i en opprinnelig granitt eller gneis er “kantet” og de blir avrundet av sedimentære prosesser.**



**Tynnslip. Anbefaler at du leser denne wikipedia siden (men ikke pensum):**

**[https://en.wikipedia.org/wiki/Thin\\_section](https://en.wikipedia.org/wiki/Thin_section)**

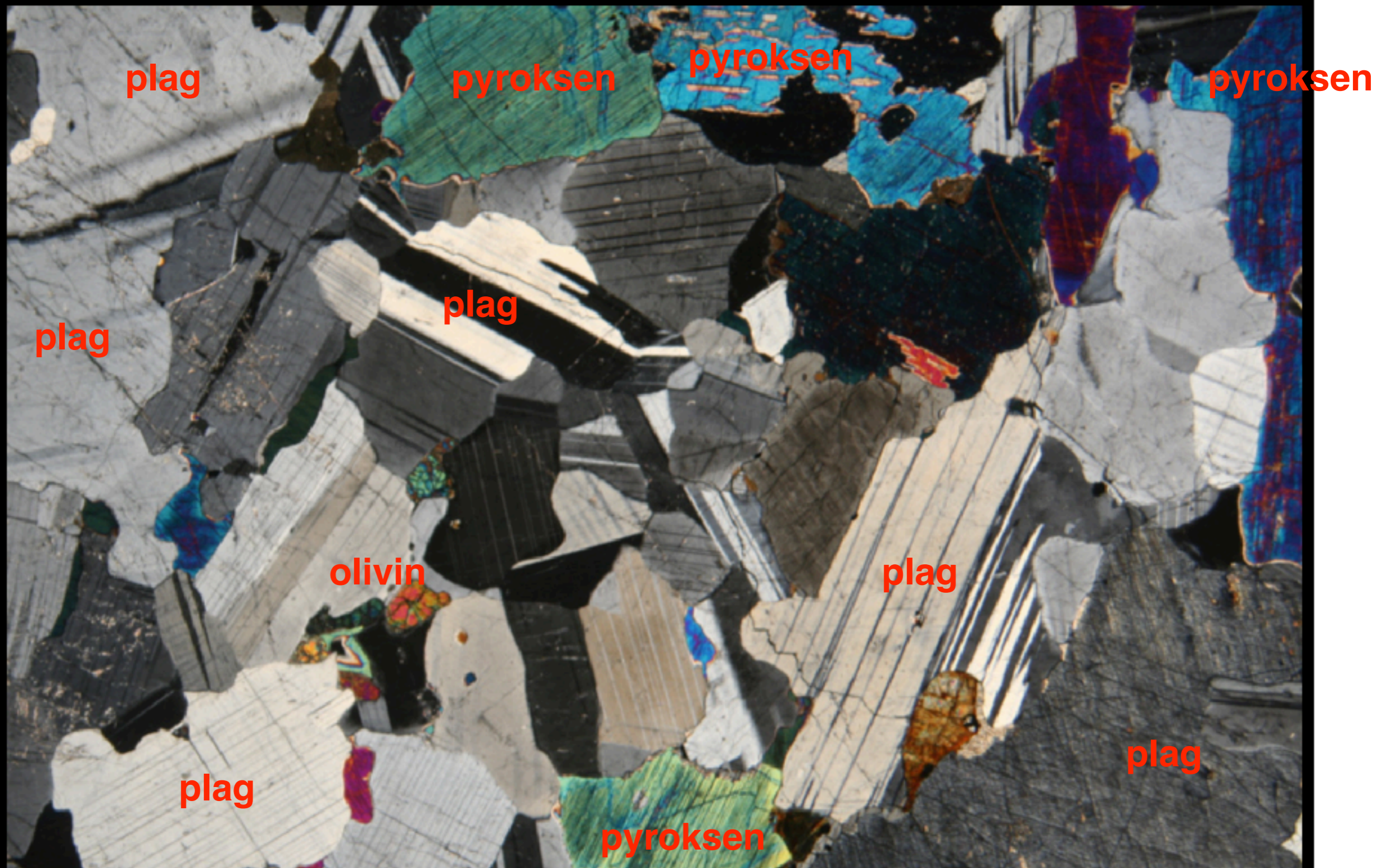




# Gabbro (grå er plagioklas, blå og grønn med kløv er pyroksen, korn uten kløv er olivin)

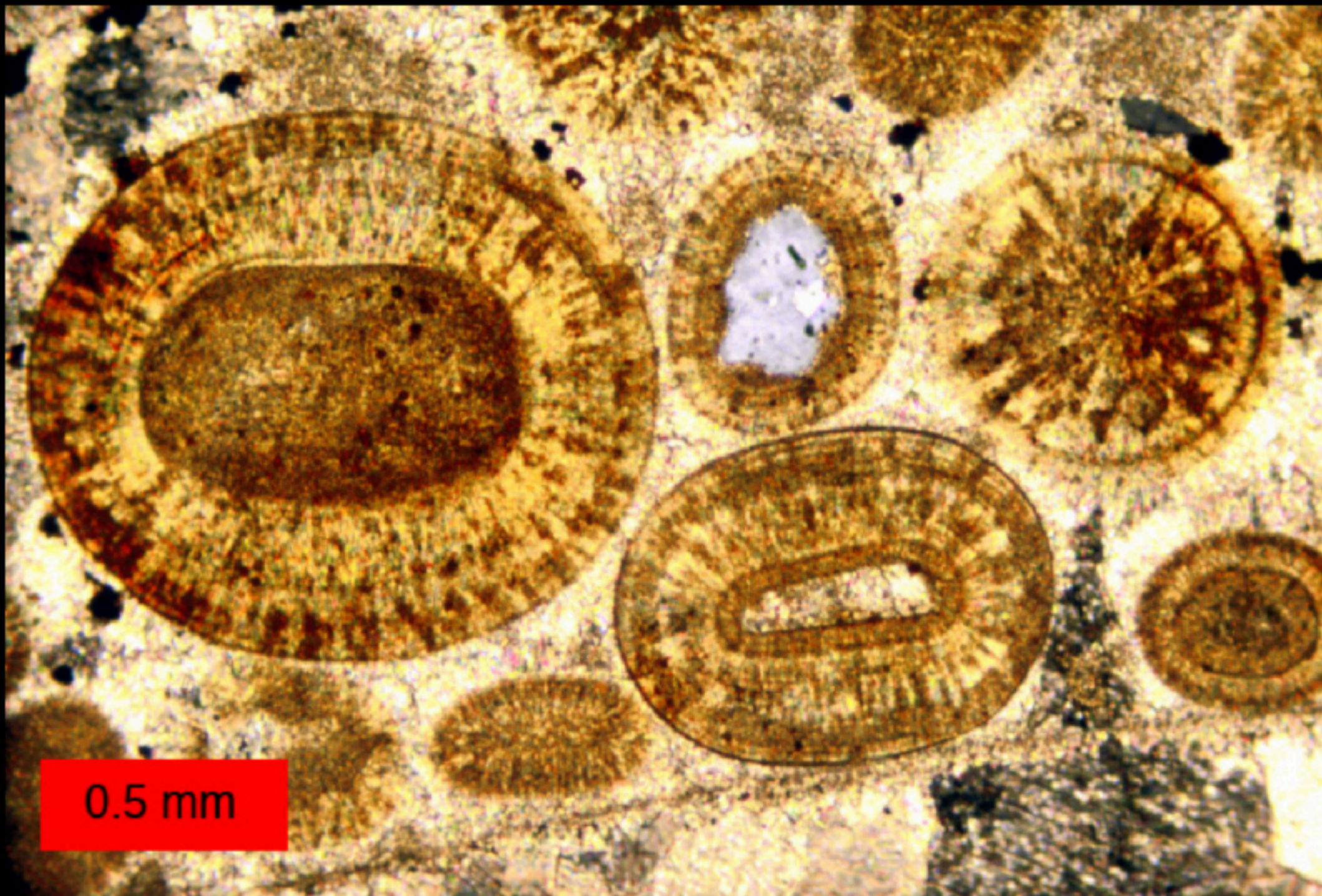
Gabbro pmg ss 2006 - Thin section - Wikipedia

File:Thin sections.JPG - Wikipedia





# Ooider (kalsitt sandkorn med overvekst av brun-gul kalsitt) og lys kalsitt sement



0.5 mm

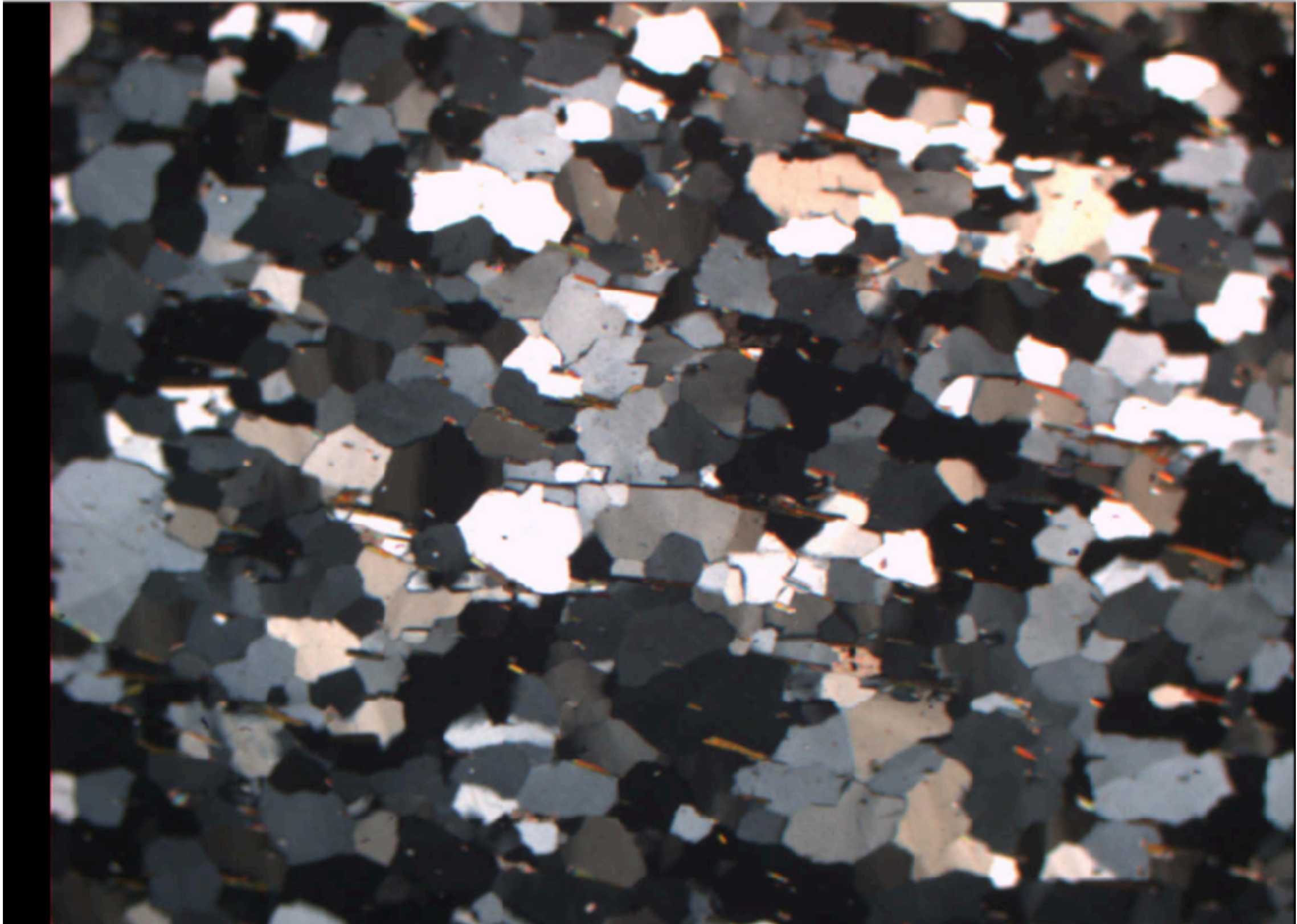


# Metamorf sandstein (kvartsitt)

Alle korn her er kvarts.

Thin section image of quartzite - Thin section - Wikipedia

File:Thin sections.JPG - Wikipedia





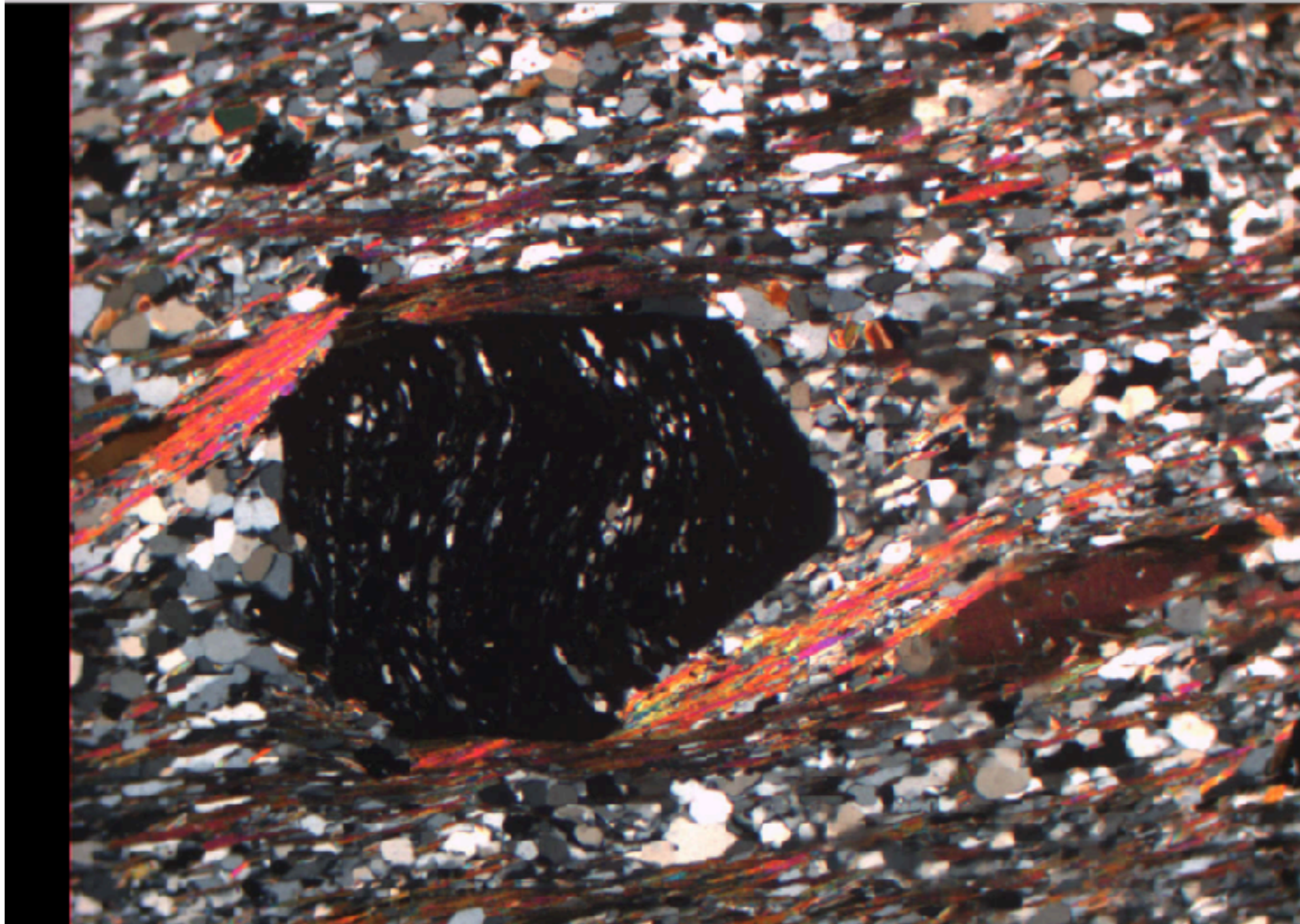
# Glimmerskifer.

De hvite og grå korn er mest kvarts.

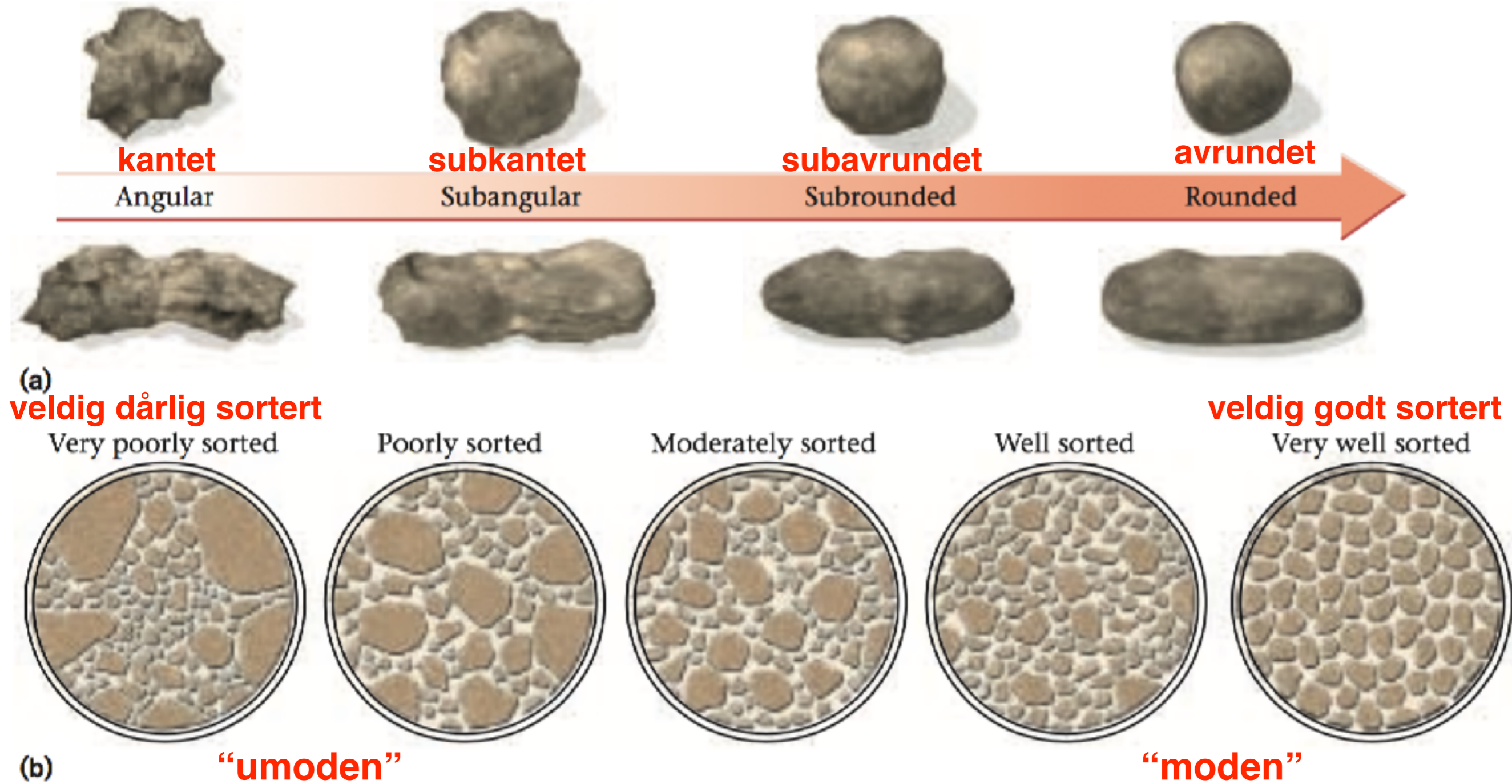
I tillegg ser man glimmer foliasjon og en granat som har rullet med klokka og har inneslutninger av kvarts og glimmer fra fyllitt, fra når kornstørrelsen var mindre.)

Thin section of garnet-mica-schist - Thin section - Wikipedia

File:Thin sections.JPG - Wikipedia

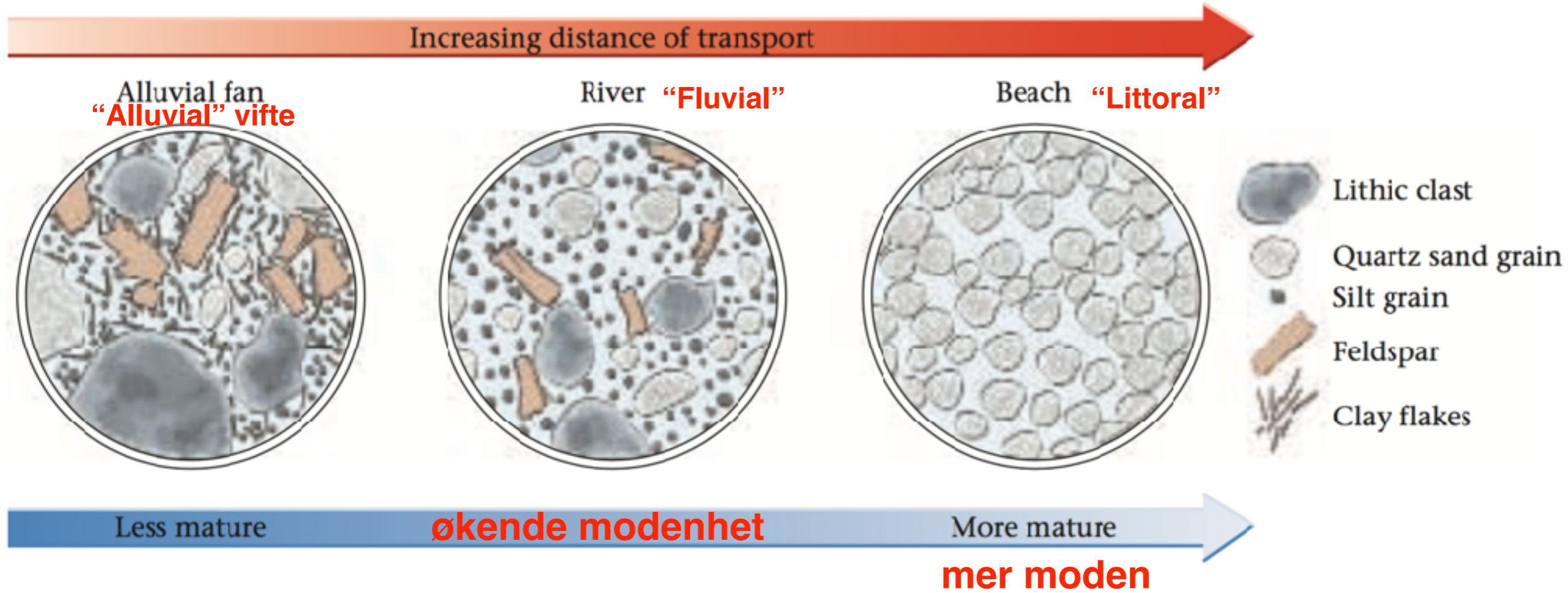






**FIGURE 7.18** (a) A grain with high sphericity (top row) has roughly the same length in all directions, whereas one with low sphericity is elongate or flattened (bottom row). Sphericity is independent of angularity, which refers to whether the grain has sharp corners or edges or not. Grains on the left are more angular than grains on the right. (b) In a poorly sorted sediment, there is a great variety of different clast sizes, whereas in a well-sorted sediment, all the clasts are the same size.

**fordel å se tynnslip i mikroskop**



I et "modent" sediment, ustabile mineraler blir borte, og stabile mineraler er avrundet og sortert.

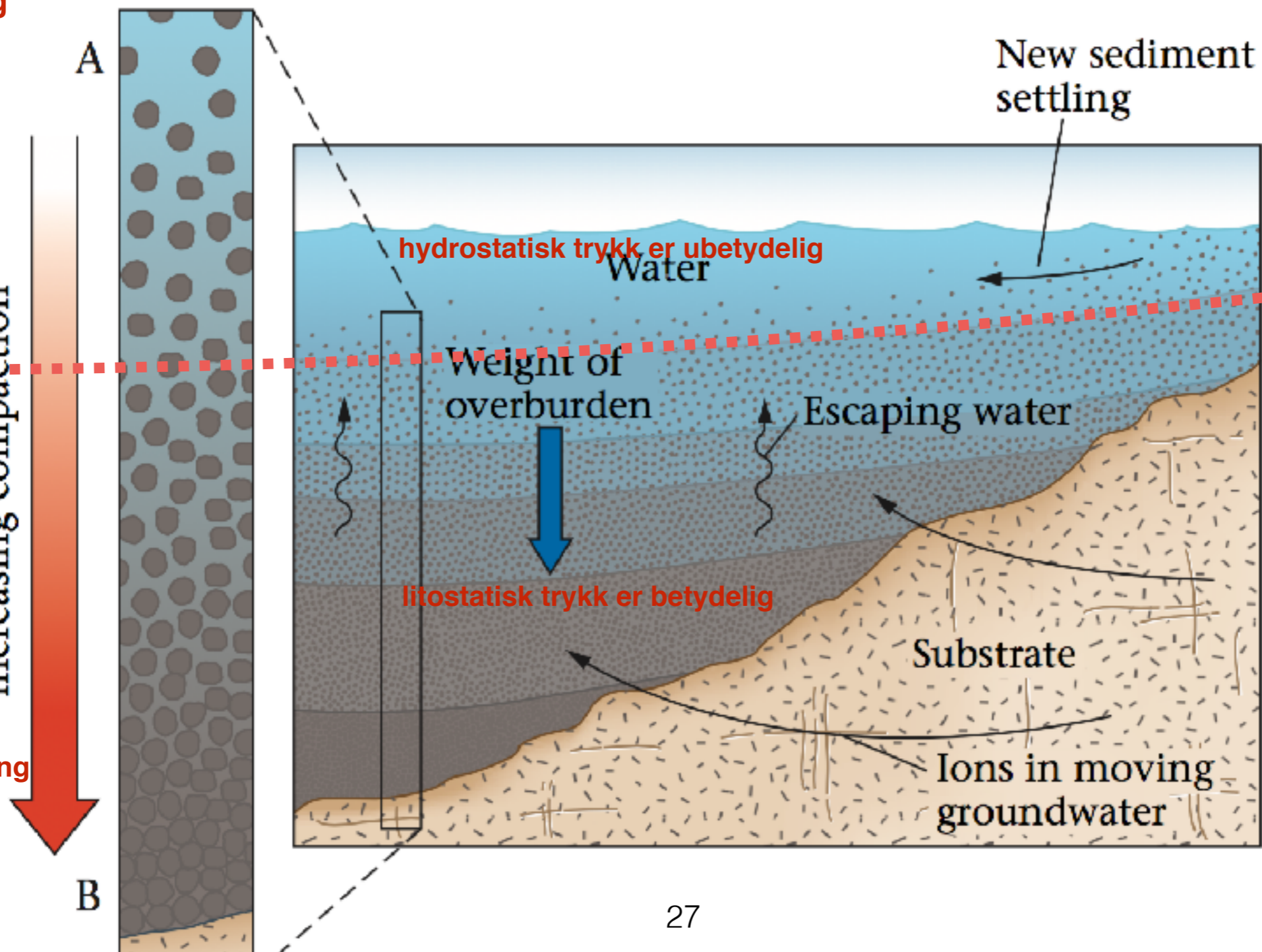


**litifisering**

**FIGURE 7.17** The process of lithification. As sediment is buried, it becomes compacted (expelling the water between the grains), and the grains pack tightly together. Groundwater passing through the rock precipitates ions to form mineral cements that bind the grains together. If there is clay in the rock, weak chemical bonds may cause the clay grains to stick to each other.

forvitring  
transport  
(erosjon)  
avsetning  
**overleiring**  
**kompaksjon**  
**sementering**  
**litifisering**

grense?  
Increasing pressure and  
increasing compaction  
kompaksjon  
sammenpressing

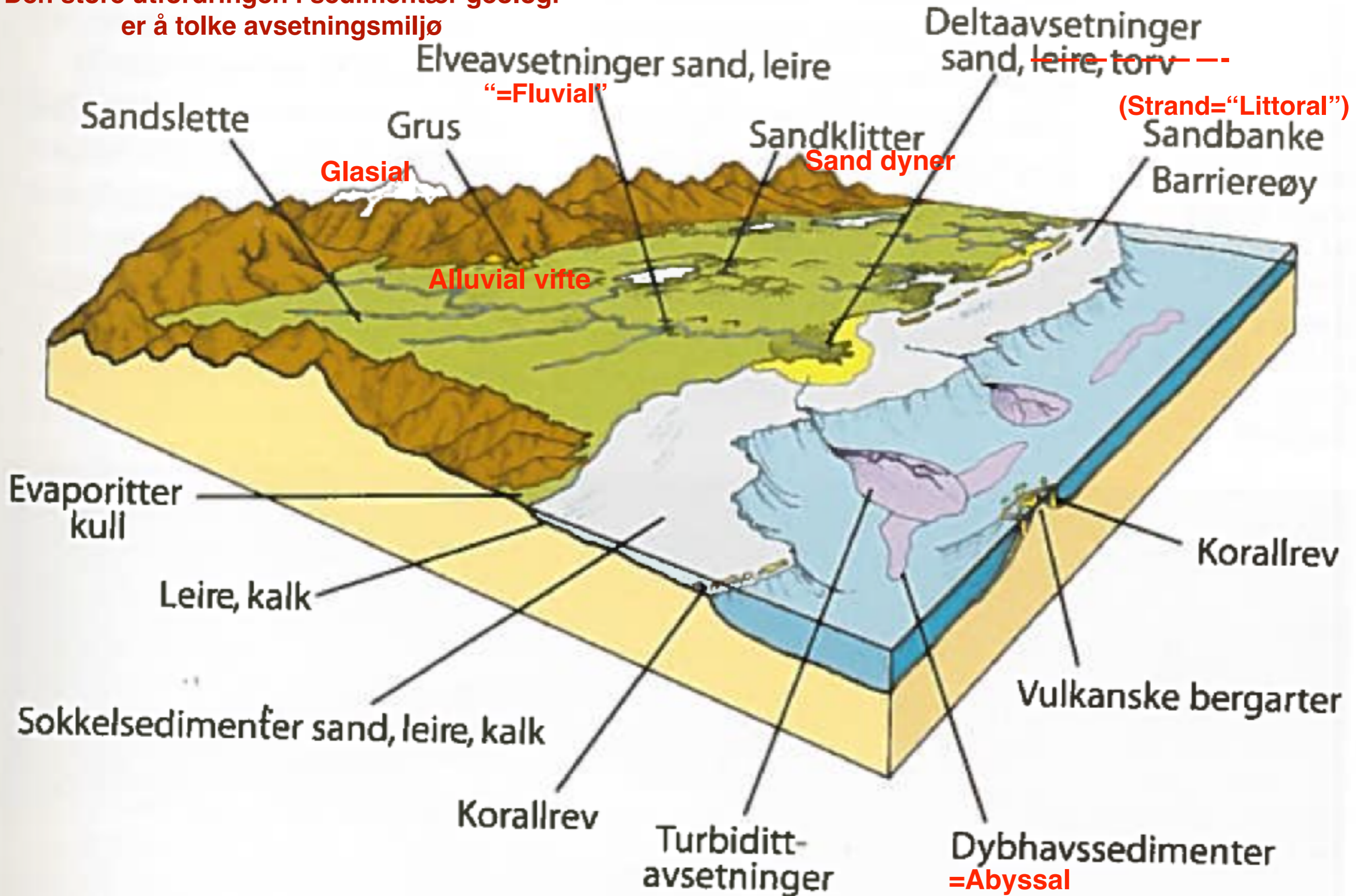


Hvor er grensen??

Marshak bør ha tegnet tydelig grense mellom vann og sediment.



Den store utfordringen i sedimentær geologi er å tolke avsetningsmiljø





**(facies)**  
**Sedimentære faguttrykk. (Vitenskapsfolk er glade i sin sjargong.)**

**Abyssal (dyphav)**

**Alluvial (avsatt av periodisk bekkevann)**

**Eolisk (vindavsatt)**

**Fluvial (elv)**

**Glacial (isbre)**

**Lakustrin (innsjø)**

**Littoral (havstrand)**

**Pelagisk (åpen hav uten påvirkning fra land)**

**Marin (har med havet å gjøre)**

**Terrestrisk (ikke marin)**



Tabellen her gjelder “klastiske” eller “detritiske” sedimentær ba.  
 (klast betyr fragment)  
 (detritus betyr avfall som ligger løst)  
 Størrelses begrep: blokk, stein, grus, sand, silt, leire.

(clastic only)

**TABLE 7.3** Common Types of Sedimentary Rock

Clast Size*	Clast Character	Rock Name (Alternate Name)
Coarse to very coarse	Rounded pebbles and cobbles <b>avrundet</b>	<b>Conglomerate</b>
	Angular clasts <b>kantet</b>	<b>Breccia breksje</b>
	Large clasts <sup>1</sup> in muddy matrix <sup>2</sup> ( <b>2 størrelser</b> )	<b>Diamictite diamiktitt (betyr 2-miks)</b>
Medium to coarse	Sand-sized grains	<b>Sandstone</b>
	▪ quartz grains only	▪ quartz sandstone (quartz arenite)
	▪ quartz and feldspar sand	▪ arkose
	▪ sand-sized lithic clasts	▪ lithic sandstone
	▪ sand and lithic clasts in a clay-rich matrix	▪ wacke (informally called graywacke)
Fine	Silt-sized clasts	<b>Siltstone</b>
Very fine	Clay and/or very fine silt	<b>Shale</b> (if it breaks into platy sheets)
		<b>Mudstone</b> (if it doesn't break into platy sheets)

Norske ord er omtrent like, men:  
 Leirskifer / shale (mulig å dele i plater)  
 Slamstein / mudstone  
 Slam=mud. En blanding av silt og leire.

Marshak har glemt:  
 Claystone / Leirstein

# Konglomerater er spesiell fordi mye kan bestemmes uten mikroskop



Konglomerat. De avrundete **bollene** av kartsitt og **(kvartsitt)** gneis er 5-10 cm store. (Biskopåsen, Ringsaker)

Geologer kaller rullestein i konglomerat "boller" (De kalles ikke "rullestein")



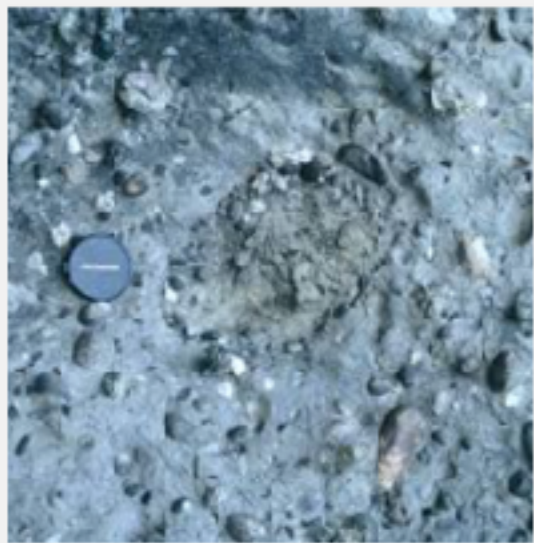
Konglomerat tilhørende sparagmittene rundt Østerdalen (Biskopåsen, Ringsaker)

("Sparagmitt" er et gammelt norsk begrep for sandsteiner i sørøst Norge.)

disse to bilder viser "polymikt, steinbårete" konglomerater

"Monomikt" / *monomict* kun 1 bolletyp  
"Polymikt" / *polymict* mange bolletyper

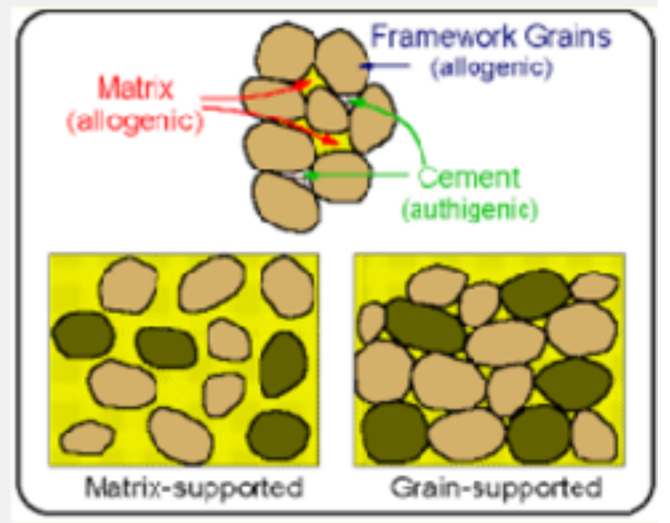
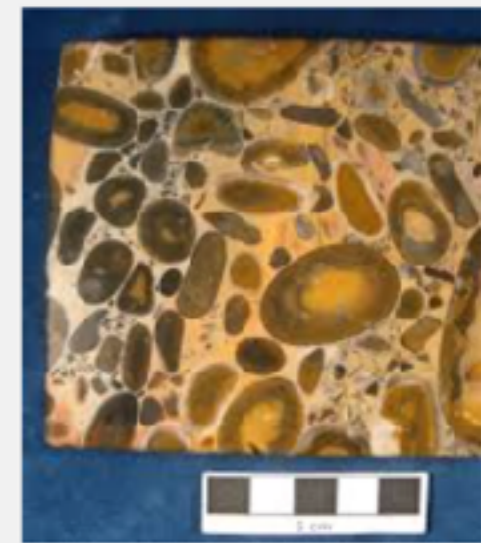




Matrix Supported Conglomerate (Glacial/Landslide Deposits)

"Modern" Glacial Sediments

2.2 Gyr Conglomerate





# Breksje

Det er flere typer breksje, som er utfordring å tolke



Schou Jensen.pdf (page 75)

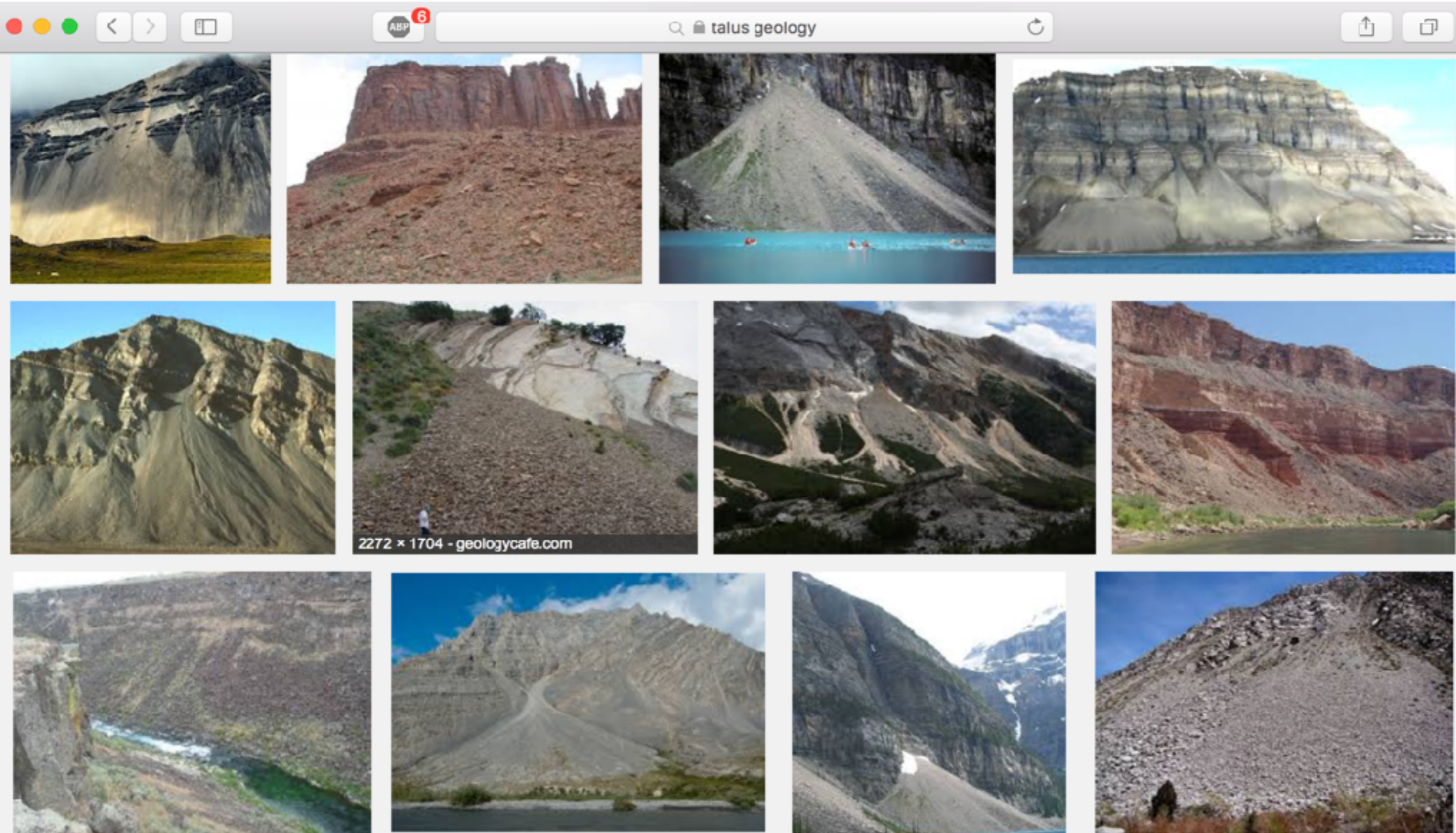


Talusbreksje  
dannet ved  
sementering av  
løst nedrast mate-  
riale ved foten av  
en fjellvegg (West-

**talus = ur**



# Ur / talus



**Blir til sedimentær breksje (Jensen sier "talusbreksje").  
Alle klaster kommer fra fjell like over. Ikke fra en bekk eller bekkedal.**



# forkastningsbreksje

The image is a screenshot of a Google Images search for "fault breccia". The search bar at the top contains the text "fault breccia" and a magnifying glass icon. To the right of the search bar are links for "Privacy, simplified" and a speaker icon. Below the search bar are navigation options: "All Images", "Videos", "News", "Maps", and "Settings". Further down are filter options: "All Regions", "Safe Search: Moderate", "All Sizes", "All Types", "All Layouts", and "All Colors". The main area displays a grid of 24 images, each with a small thumbnail and a caption below it. The captions include sources like "Wikipedia", "Alamy", "ThoughtCo", "Geology Superstore", "Flickr", "Blogs.agu.org", "Earthsci.org", "Monash.edu", and "Panoramio.com". The images themselves show various geological features: some show close-ups of rock textures with angular fragments, others show fault lines cutting through layered rock, and some show large-scale views of fault breccias in a field setting with a person for scale.

**I forkastningsbreksje er klaster fra begge sider av en smal forkastningszone. (Ingen klaster har kommet fra fjerne bergarter.)**



## Breksje



Talusbreksje  
dannet ved  
sementering av  
løst nedrast mate-  
riale ved foten av  
en fjellvegg (West-

Det finnes flere breksje typer, blant annet:

***Sedimentær breksjer (for eks. talusbreksje, rasbreksje)***

***Forkastningsbreksje***

***Pyroklastisk breksje (vulkansk)***

***Meteoritt nedslags breksje***





pyroclastic breccia **pyroklastisk breksje**



**Klaster er vulkansk, kommer fra samme vulkan.**

All Images Videos News Maps

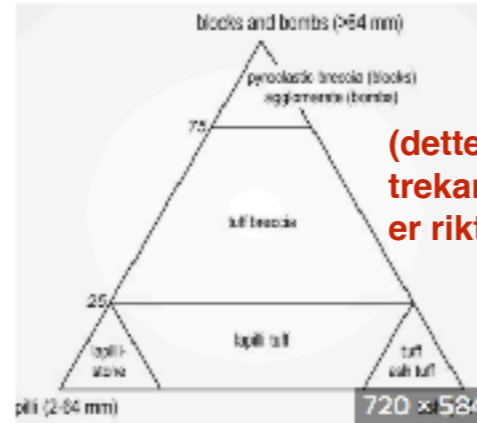
Settings



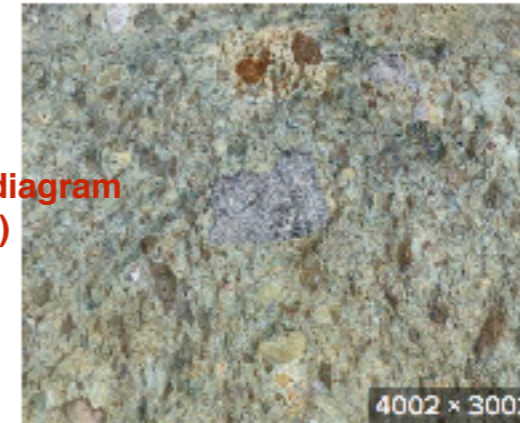
Patterns In Pyroclastic Breccia near ... natureinfocus.blog



Patterns In Pyroclastic Breccia near ... natureinfocus.blog



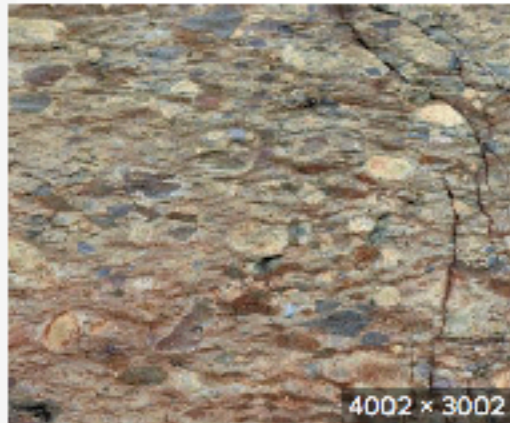
Igneous rocks sandatlas.org



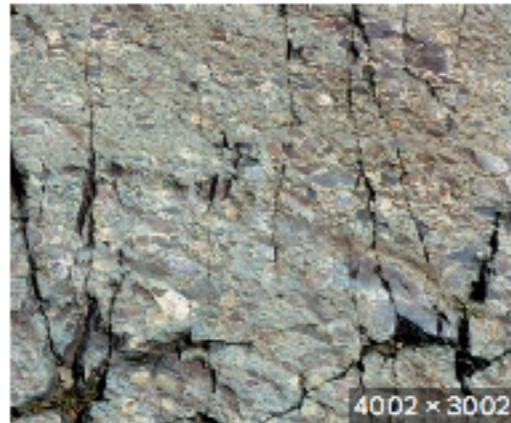
Patterns In Pyroclastic Breccia near ... natureinfocus.blog



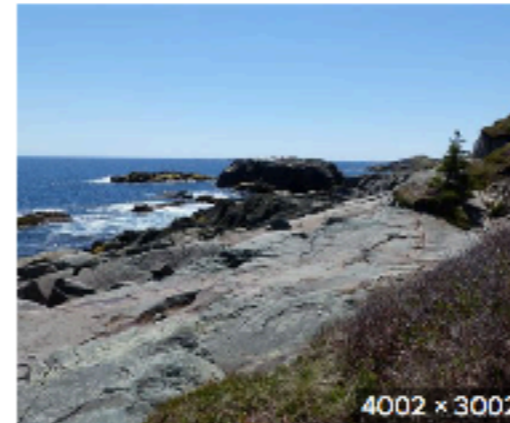
Patterns In Pyroclastic Breccia near ... natureinfocus.blog



Pyroclastic Breccia Patterns 34 – J... natureinfocus.blog



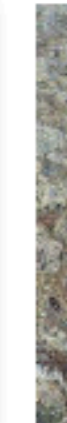
Patterns In Pyroclastic Breccia near ... natureinfocus.blog



Pyroclastic Breccia Patterns 2 – Jes... natureinfocus.blog



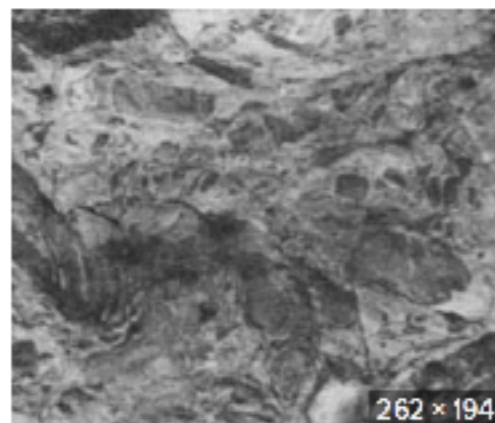
Volcanic breccia Stock Photo - Alamy alamy.com



Volcanic breccia Stock Photo - Alamy alamy.com



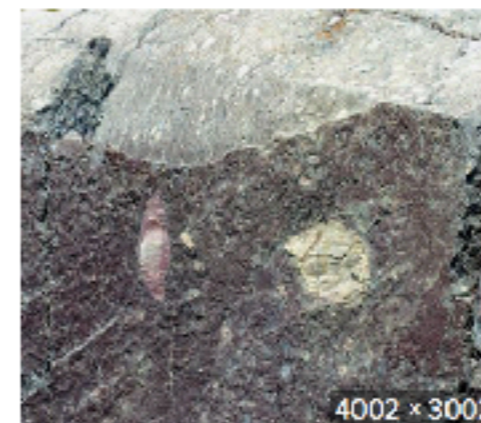
Pyroclastic Breccia Patterns 21 ... natureinfocus.blog



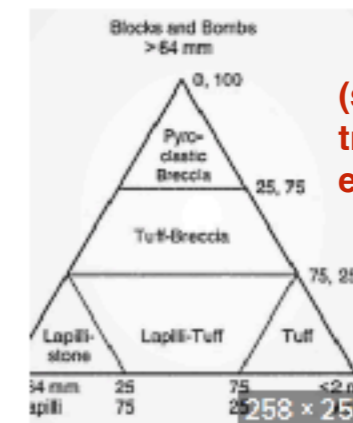
Volcanic breccia | SpringerLink link.springer.com



(a, c) pyroclastic la... researchgate.net

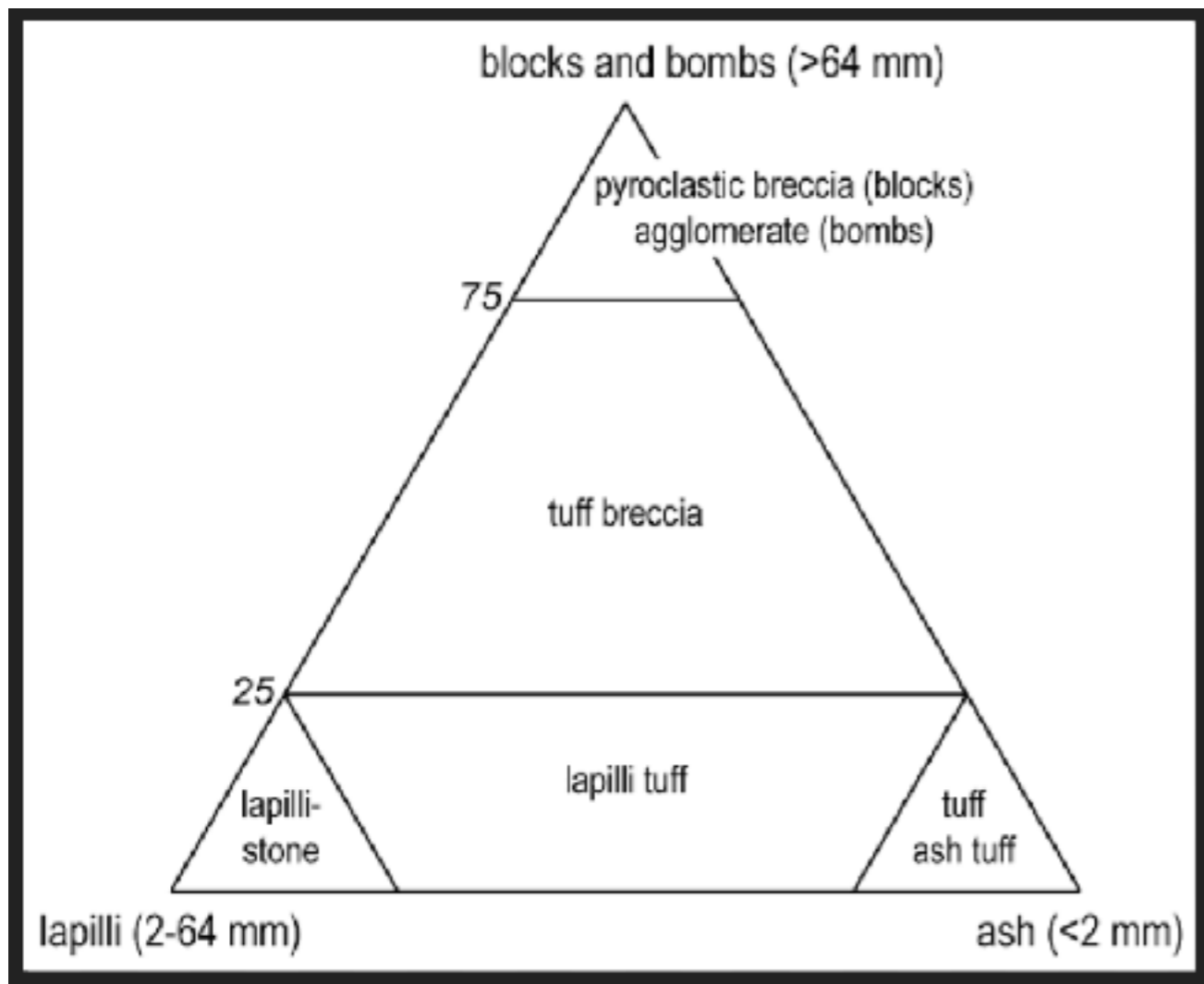


Patterns in Pyroclastic Breccia ne... natureinfocus.blog

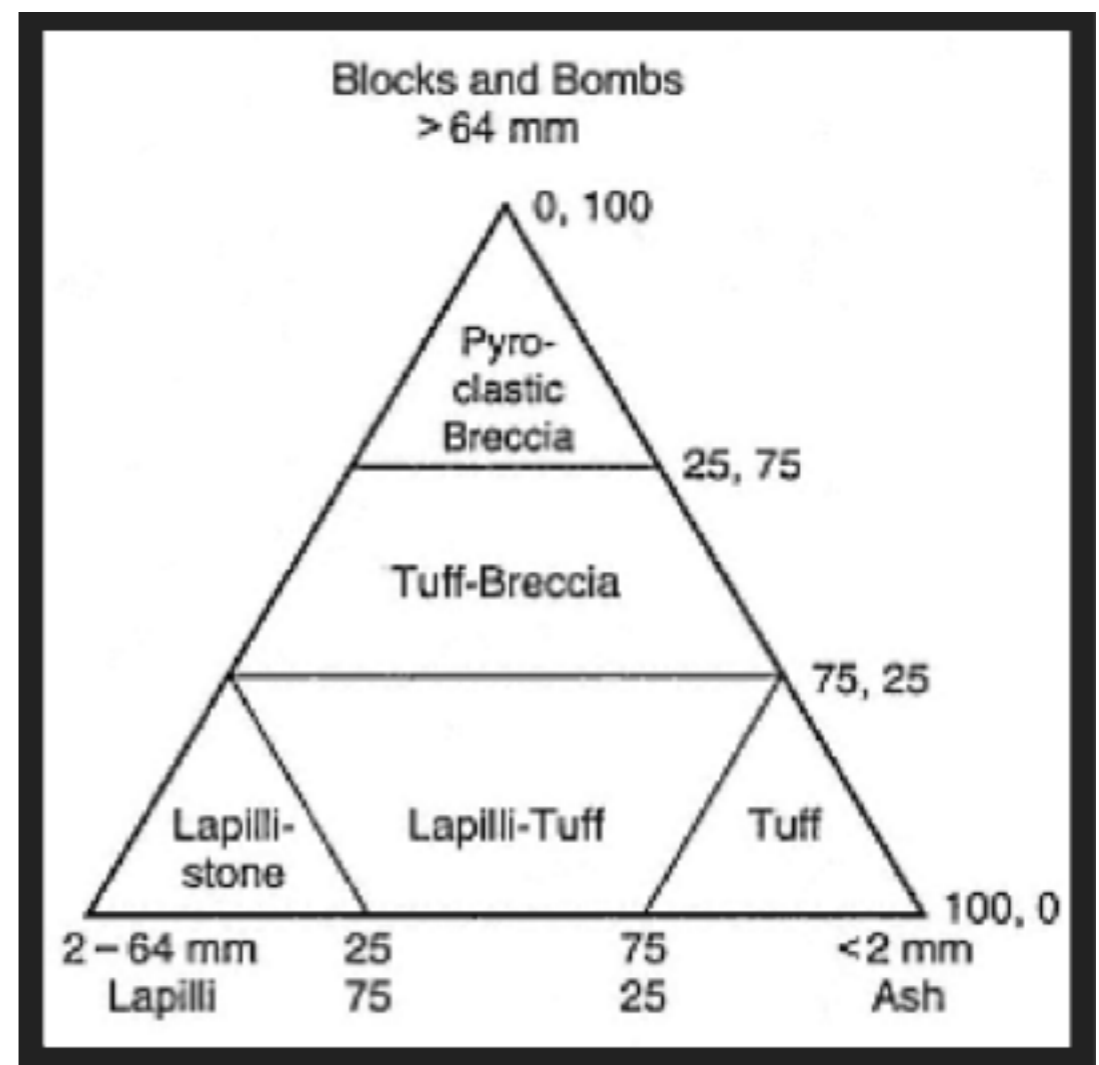


Volcanology and Geoth... publishing.cdlib.org





:=)



:=)





Klaster av bergartene som ble truffet av meteoritten.





# Gardnos meteorittkrater

[Store norske leksikon](#) / [Realfag](#) / [Geologi](#) / [Meteoritter](#)

Gardnoskrateret er et [meteorittkrater](#) på Garnås i [Nes kommune](#), [Viken fylke](#) (tidligere [Buskerud](#)). Krateret ligger nær riksvei 7 i [Hallingdal](#) og er lett tilgjengelig med et eget besøkssenter.

**UTTALE:** ɡardnos-strukturen

Man kan fremdeles se konturene av krateret og høyden i sentrum, men det er ikke lenger en sirkelformet grop i bakken. Den østlige kraterveggen har istidene tatt knekken på, og skog dekker store deler av området. I dag er det de spesielle bergartene og ikke kraterformen som forteller historien om hva som skjedde for 546 millioner år siden.

## Oppdagelse og undersøkelse

Krateret ble første gang undersøkt under kartlegging av [Hallingdal](#) i 1948, da statsgeolog O. A. Broch oppdaget en ringstruktur bestående



Gardnosbreksje

Av Øivind Thoresen/Naturhistorisk museum, UiO.

Lisens: Begrenset gjenbruk