Land surface processes, acidification and eutrophication (project 2 and 3)

NGEA09, 2019

Cecilia Akselsson
Department of Physical Geography and Ecosystem Science
Lund University
What will we do in this module of the course

• A few lectures (as a basis for the project work)

• Project work 2: Weathering and sustainable forestry in Västra Götaland

  including:

  Field trip to a forest catchment in Västra Götaland

• Project work 3: Phosphorous leaching from agricultural land in Skåne
Goal for this part of the course

- To understand the Swedish landscape, landforms and its properties (slopes, mineral content, soil type, etc) and how and when it was formed.

- To be able to connect this to environmental issues.

- To understand your roles as physical geographers in this context.
Understanding the landscape – essential when working with environmental issues
Project work 2 – Weathering and sustainable forestry
Project work 3 – Phosphorous leaching from agriculture

Photo: Cecilia Akselsson
Field trip

Photo: Cecilia Akselsson

Photo: Cecilia Akselsson
Litterature

Mc’Knights Physical Geography - A landscape appreciation, by D. Hess

Water’s journey from rain to stream, by H. Grip and A. Rodhe (Vattnets väg från regn till back)

Reports and papers that are handed out during the course

Your own literature search

In Swedish:
Sveriges Nationalatlas: Atlas över Skåne, by T. Germundsson and P. Schlyter

Sveriges Nationalatlas: V. Götaland, by B. Frizell & M. Werner (in English at UB)

Sveriges geologi från urtid till nutid, by M. Lindström m.fl.
Today’s lectures 9-12

- Land surface processes (focus: Sweden)
  - Endogene processes
  - Mass movements
  - Glacial erosion processes
  - Fluvial erosion processes
  - Coastal erosion processes
  - Eolian erosion processes

- Acidification and eutrophication

- Intro project 2
Processes: Endogene and exogene

(From Hess, 2013)
Geomorphological processes and landforms all over the world

**Periglacial processes**
Polygon wedge ice: Svalbard

**Glacial processes**
Esker: Dalarna, Sweden

**Endogene processes**
Volcano, Mexico

**Eeolian processes**
Dunes: Namibia

**Mass movements, fluvial processes, coastal processes**
Braided channel, New Zealand

*Photo: Jonas Åkerman*
History of the earth

(Modified from Hess, 2013)
Endogene processes - forms many landforms and rocks

- Driven by plate tectonics

- Creation of mountain ranges, horsts, faults; Volcanism and metamorphism

From Hess, 2013

Photo: Cecilia Akselssom
Three types of rocks with different origin

1. Igneous rocks
   - Plutonic (intrusive)
   - Volcanic (extrusive)

2. Sedimentary rocks

3. Metamorphic rocks
Three main units in Swedish bedrock

- The Baltic/Fennoscandian shield ("urberget")
- The Caledonides (Kaledoniderna, "fjällkedjan")
- Sedimentary bedrock
The baltic/fennoscandian shield

- Formed during precambrium (>545 million years ago)
The Caledonides- Fjällkedjan

-Formed after a collision 500 – 400 million years ago

-Sandstone, quartzite, limestone, shale, amphibolite, gneiss, marble and more...from precambrium to devon

Photo: Cecilia Akselsson
Remains from a collision between Baltica and Laurentia 500-400 million years ago

From Hess, 2013
Sedimentary bedrock
Cambrian to tertiary

Submerged thus protected (Siljanringen); meteorite 360 million years ago

Cambrium, ordovicium, silur, trias, jura, tertiary

Diabase covering and protecting (e.g. Billingen)

Bottom of Baltic sea
Lime in bedrock and soils
The Tornquist zone
Collision 400 million years ago, movements along the zone mainly during the cretaceous and tertiary periods.

*From Hess, 2013*
Earth quakes along the zone (weak but still....)
A volcano in Skåne: Jällabjer, ca 150 million years old

Photo: Jonas Åkerman
The horsts in Skåne

- Hallandsåsen
- Nävlingeåsen
- Linderödsåsen
- Kullen
- Söderåsen
- Romeleåsen
Clear NW-SE pattern in land use

Legend:
- Berg (Rock)
- Myr (Mire)
- Skog (Forest)
- Tätort (Urban area)
- Vatten (Water)
- Åker (Agriculture)
Exogene processes: Mass wasting and erosion

From Hess, 2013
Mass wasting - Söderåsen
Erosion (glacial, fluvial, eolian, coastal)

- "Release" of material
- Transport
- Deposition

(From Hess, 2013)
Glacial erosion processes

(Photo: Jonas Åkerman)
The Quaternary period: 2,600,000 – 10,000 years ago
(The age of the earth: 4,600,000,000 years)

- Several ice ages during the quaternary period
- Last one: Weichsel 110,000-10,000 years ago
Pleistocene glaciation – maximum extent

(From Hess, 2013)
Landforms caused by continental ice sheets

(From Hess, 2013)
Swedish soils and many of the landforms: Formed by the ice ages

(Photo: Cecilia Akselsson)
The development of the Baltic sea during ice retreat

1 10 200 BP

2 9 800 BP

3 9 500 BP

4 6 500 BP

Baltiska issjon

Yoldia havet

Ancylus sjön

Litorina havet

(skoltips.wordpress.com)
Highest coast line (högsta kustlinjen)
Soil types in Sweden

- Torv (Mires)
- Lera (Ccay), finmo (silt)
- Grovmo (silt), sand, (sand) grus (gravel)
- Isälvsediment (glaciofluviial sediments)
- Lerig morän, (clayey till) moränlera (till clay)
- Morän (till)
- Kalt ber/tunt jordtäcke (bare rock/thin soils)
- Glaciär (Glacier)
- Sjö (Lake)
Soil types determinant for land use...
..and hydrological properties, e.g. permeability

SNA, Berg och Jord
Another effect of glacial processes – land uplift

www.lantmateriet.se
Fluvial processes – contributes more to shaping landforms than all the other external processes together

(From Hess, 2013)
Oversized valley in Rövarekulan

(Photo: Cecilia Akselsson)
Fluvial landforms

Valley shaped by fluvial processes to a V-valley, and reshaped by glaciation to U-shaped valley

Photo: Jonas Åkerman
Soil types in Sweden – red and dark green are fluvial sediments

- Torv (Mires)
- Lera (Ccay), finmo (silt)
- Grovmo (silt), sand, (sand) grus (gravel)
- Isälvs sediment (glaciofluvial sediments)
- Lerig morän, (clayey till) moränlera (till clay)
- Morän (till)
- Kalt ber/tunt jordtäcke (bare rock/thin soils)
- Glaciär (Glacier)
- Sjö (Lake)
Coastal processes – reshaping due to wave activities

Washed tills below highest coastline

(SGU)
Coastal processes – reshaping due to wave activities

“Raukar” Gotland

(SGU)
Eolian processes

Coastal dunes
The landforms, topographical and hydrological patterns and the soil properties are the results of many different processes acting on different time scales.

Example: (Washed till) “Svallad morän”

- Endogene processes explains mineralogical composition
- Glacial processes have broken down and moved the material
- Coastal processes (below highest coastline) have washed the till