## Kenozoik
## NEOGEN
## KVARTAR

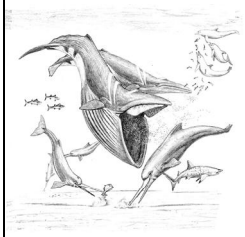
## Neogen

- **neogen**
  - **miocen (eger, egenburg, otnang, karpat, baden, sarmat, panon, pont): 23 - 5,3 mil. god.**
  - **pliocen (zanklij, piačenzij): 5,3 - 2,6 mil. god.**
- ***kvartar***
  - **gelasij: 2,6 - 1,8 mil. god.**
  - **pleistocen: 1,8 mil. god. - 11.500 god.**
  - **holocen: 11.700 god. -**

- **važniji biološki događaji**
  - **d. miocen: prvi homonoidi**
  - **d. pliocen: prvi hominidi**
  - **d. pleistocen: Homo erectus**
  - **g. pleistocen: Homo sapiens**

- **važniji paleogeografski događaji**
  - **miocen, pliocen: kolizija Indije i Euroazije**
  - **d. miocen: početak formiranja Paratethysa**
  - **sr. miocen: početak formiranja Crvenog mora**
  - **pliocen: zatvaranje Paratethysa**
  - **pleistocen: oledba**

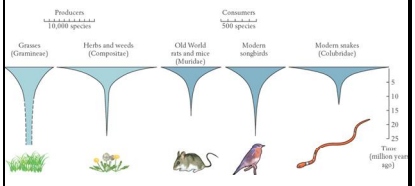
## Neogenski život



Å život u moru
- ï miocenski pretci kitova
- ï miocenska obnova planktonskih foraminifera

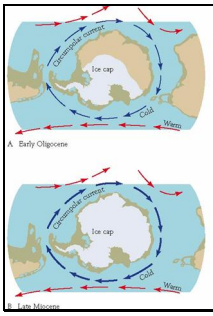
Stanley, 2005, Freeman

## Neogenski život




Å život na kopnu
- ï hladniji i suhi periodi smanjivali područja pod šumama

Stanley, 2005, Freeman

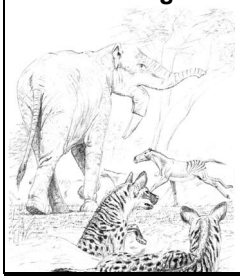



## Neogenski život

Å strujanje oko pola
- ï omogućen razvoj ledenjaka na Antarktici

Stanley, 2005, Freeman

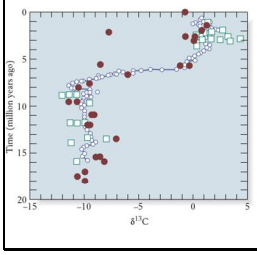
## Neogenski život



- sisavci
  - razvoj grupa velikih sisavaca
  - mnogi prilagođeni otvorenim područjima
  - daljnji razvoj primata

Stanley, 2005, Freeman

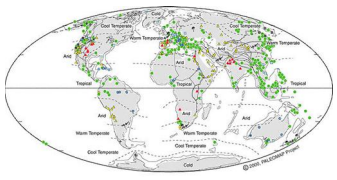
## Neogenski život




- prije 6 - 7 mil. god. izumiranje dijela sisavaca
- širenje $C_4$ trava
- promjena globalne klime u topliju

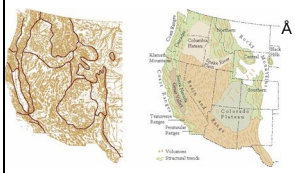
Stanley, 2005, Freeman

## Klima



Miocen

## Regionalni događaji - zapad



Å izdizanja i magmatska aktivnost formirali zapadne provincije

Stanley, 2005, Freeman

## Regionalni događaji - zapad

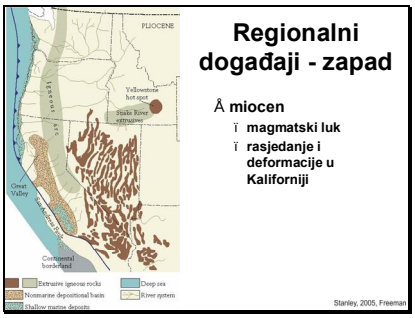
Å Basin and Range provincija se razvila u neogenu.

Stanley, 2005, Freeman


## Regionalni događaji - zapad

Å miocen
- ï subdukcija na sjeveru
- ï rasjedanje i izgradnja planina na jugu

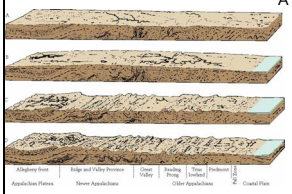
Stanley, 2005, Freeman



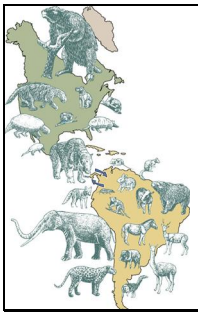

## Regionalni događaji - zapad

- Å **miocen**
  - ï **magmatski luk**
  - ï **rasjedanje i deformacije u Kaliforniji**

## Regionalni događaji - istok




- Å **izdizanje u kenozoiku praćeno snažnom erozijom**

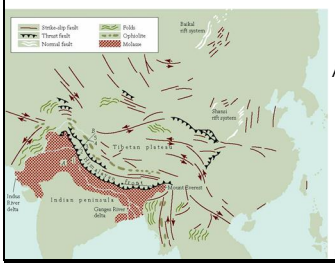


## Američka razmjena sisavaca

- Å **prevlaka Paname**
  - ï **sjeverno i južnoamerički sisavci se razvijali odvojeno**

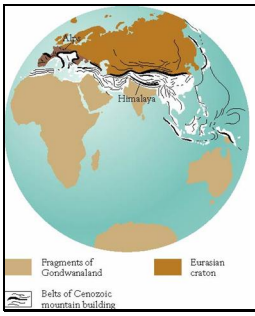
Stanley, 2005, Freeman

## Himalaja



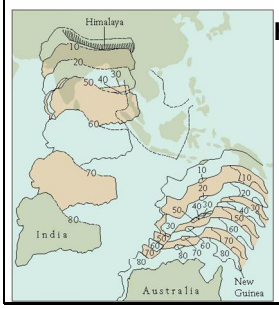

- razvoj širokog paltoa Tibeta

## Himalaja



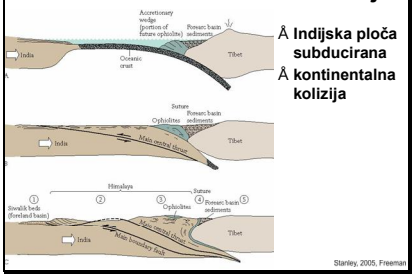

- Indijski kraton kolidirao s Euroazijom

## Himalaja



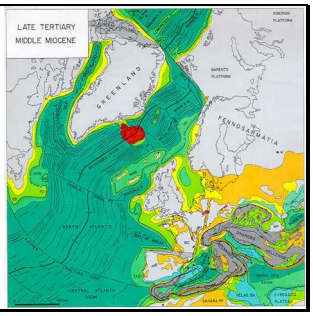

- miocenski klastiti prekrivaju eocenske vapnence
- najveće izdizanje zadnjih 15 mil. god.

## Himalaja

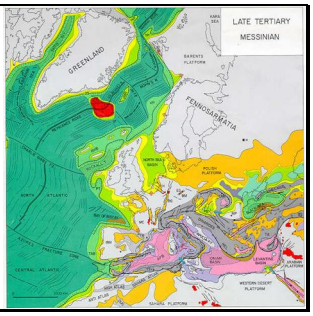



- Indijska ploča subducirana
- kontinentalna kolizija

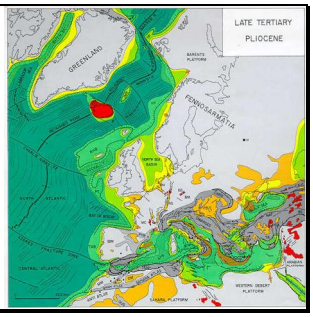
## Europa



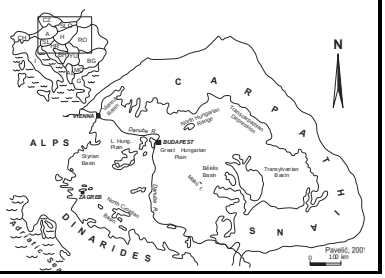

## Europa

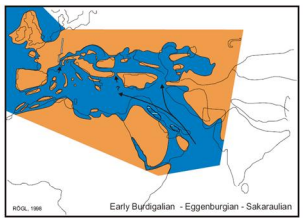


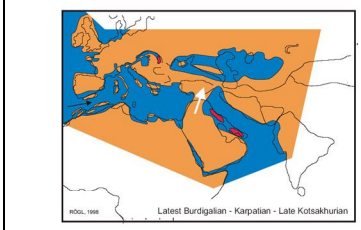
**Europa**

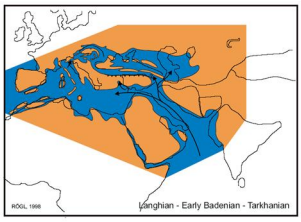


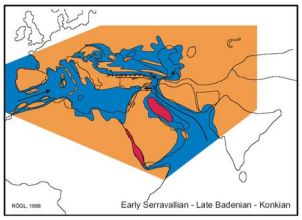

**Hrvatska**

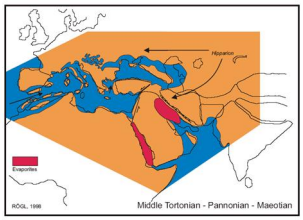


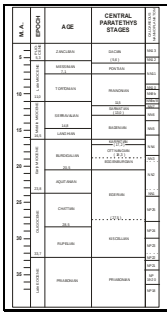




RÖGL, 1998
Latest Burdigalian - Karpatian - Late Kotsakhurian


RÖGL, 1998
Langhian - Early Badenian - Tarkhanian


RÖGL, 1998
Early Serravallian - Late Badenian - Konkian



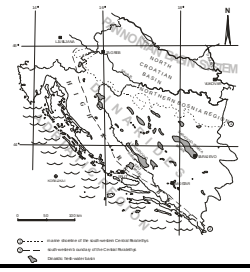

## Hrvatska

**Usporedba kronostratigrafije miocena Središnjeg Paratethysa s općom kronostratigrafijom.**

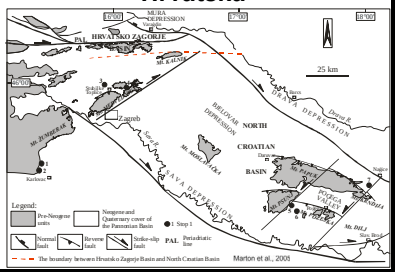
## Hrvatska

- **tri regije s različitom sedimentacijom**
  - **sjeverna Hrvatska (Središnji Paratethys, Panonski bazen)**
    - **Središnji Paratethys: dio Paratethysa između Alpa, Dinarida i Karpata**
    - **Panonski bazen zauzima najveći dio Sr. Paratethysa**
  - **slatkovodni bazeni u Dinaridima**
  - **bazen Jadrana**

## Hrvatska




## Hrvatska




## Hrvatska

- sjeverna Hrvatska
  - u donjem miocenu dva bazena s različitom sedimentacijom do karpata
    - bazen Hrvatskog zagorja
    - Sjevernohrvatski bazen

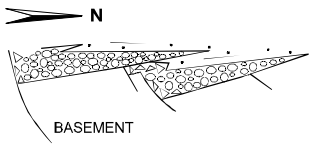
## Hrvatska

- bazen Hrvatskog zagorja
  - eger: marinska do brakična sedimentacija
    - klastiti, vulkanizam
  - egenburg - otnang: marinska sedimentacija
    - klastiti, vulkanizam

## Hrvatska

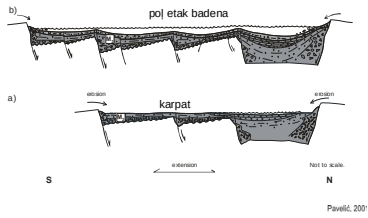
- Sjevernohrvatski bazen
  - eger, egenburg, otnang: kopno
  - karpat: početak kontinentalnog riftanja - sin-rift faza
    - spuštanje niz listričke rasjede uslijed izdizanja gornjeg plašta
    - riječni okoliši
  - početak badena: nastavak spuštanja
    - formiranje velikog slatkovodnog jezera uz promjenu klime u humidnu

## Hrvatska




Pavelić, 2001

## Hrvatska




Pavelić, 200

## Hrvatska

- **donji baden: marinska transgresija zbog uspostave veze s Jadranom - kontinuiran prelazak iz jezerske sedimentacije u marinsku**
  - **Åspojili se bazen Hrvatskog zagorja i Sjevernohrvatski bazen**
  - **Åsiltiti, pješčenjaci**

## Hrvatska

- **Åprodubljavanje ali i tektonsko izdizanje pojedinih blokova - formiranje otočnih nizova**
- **Åkarbonatna sedimentacija: biokalkareniti i lapori**
- **Åklimaks vulkanizma: bazalti i andeziti**

## Hrvatska

- **gornji baden: post-rift faza: spuštanje zbog hlađenja litosfere; marinska transgresija i preplavljivanje otoka - uspostava veze s Indijskim oceanom**
  - **biokalkareniti, lapori**

## Hrvatska

- **sarmat: početak izolacije bazena**
  - **reduciran salinitet**
  - **nestali ježinci, crvene alge, koralji, planktonske foraminifere**
  - **laminirani lapori, gline, vapnenci, pješčenjaci**
  - **pretaloživanje badenskih sedimenata**
  - **rijetki piroklastiti**
  - **koncem sarmata izdizanje i oplićavanje**

## Hrvatska

- **panon: definitivno zatvorena veza s morem, fomirano brakično jezero Panon, mjestimična transgresija na izdignute blokove**
  - **transgresija: konglomerati, lapori**
  - **kontinuitet: pločasti vapnenci, lapori**
  - **u Hrvatskom zagorju pijesci transportirani iz Alpa**
  - **Croatica naslage, Banatica naslage**
  - **razvoj endemske faune: školjkaši, puževi, ostrakodi**

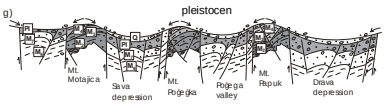
## Hrvatska

- pont: kontinuirano taloženje
  - lapori, progradacija deltnih sustava - najveći rezervoari nafte i plina
  - Abichi naslage, Rhomboidea naslage
- mesinska kriza saliniteta u Sredozemnom moru
  - potpuno isušivanje i taloženje debelih naslaga evaporita
- pliocen (dacij i romanij): početak tektonskog izdizanja, slatkovodni okoliši
  - klastiti lokalnog izvorišta, ugljen
  - Paludinske naslage

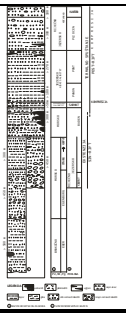
## Hrvatska

- pleistocen: riječni i barski okoliši
  - klastiti
  - les
  - snažna vertikalna izdizanja i erozija

## Hrvatska

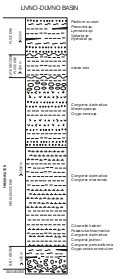



Pavelić, 2001



## Hrvatska

Pavelić et al., 2003

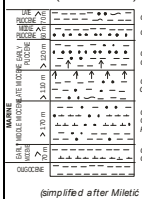


## Bosna i Hercegovina

- slatkovodni okoliši: riječni i jezerski
- izrazito prevladavanje klastita s lokalnim izvorištima
- samo endemska fauna

- u Hrvatskoj: Sinjski bazen, Pag

Pavelić, 2002



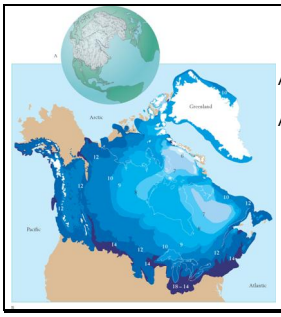

*(simplified after Miletić & Bajraktarević, 1995)*

Pavelić, 2002

## Hrvatska

- bazen Jadrana
  - marinska sedimentacija: lapori, vapnenci, pješčenjaci, evaporiti
  - mesin: isušivanje
  - pleistocen: pad razine mora

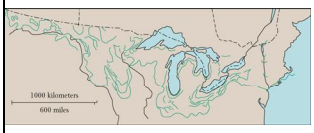
## Ledeno doba




- glacijalni maksimum
- šest glavnih dokaza
  - 1. eratički blokovi

Stanley, 2005, Freeman

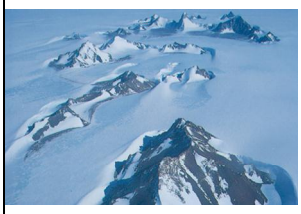
## Ledeno doba




- 2. glacijalni til i bazeni pod utjecajem glacijacije
- 3. depresije na kopnu zbog težine ledenjaka

Stanley, 2005, Freeman

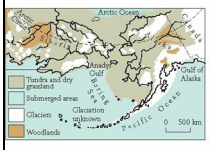
## Ledeno doba



- 4. glacijalno trljanje

Stanley, 2005, Freeman

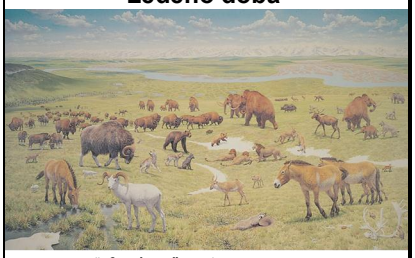
## Ledeno doba




- **5. pad razine mora**

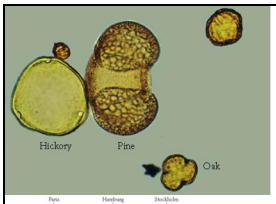
Stanley, 2005, Freeman

## Ledeno doba



- **6. migracija vrsta**

Stanley, 2005, Freeman

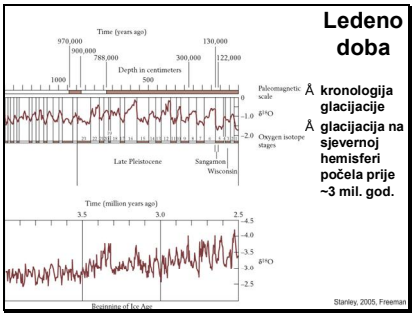



## Ledeno doba

- **polen**
  - **pomoć u rekonstrukciji promjena vegetacije**
  - **europske promjene**

Stanley, 2005, Freeman

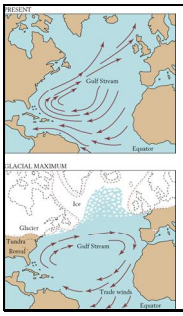
## Ledeno doba




- kronologija glacijacije
- glacijacija na sjevernoj hemisferi počela prije ~3 mil. god.

Stanley, 2005, Freeman

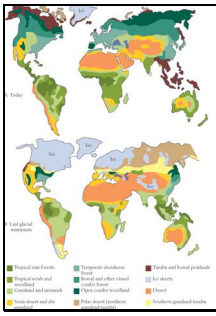
## Ledeno doba




- promjena oceanskih strujanja u vrijeme glacijacije

Stanley, 2005, Freeman

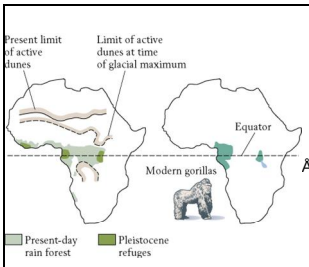
## Ledeno doba




- globalni utjecaj klime na vegetaciju

Stanley, 2005, Freeman

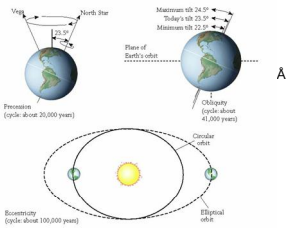
## Ledeno doba




- globalan utjecaj na klimu
  - Sahara se proširila

Stanley, 2005, Freeman

## Ledeno doba




- orbitalni ciklusi
  - promjene u Zemljinoj orbiti su vezane uz glacijaciju

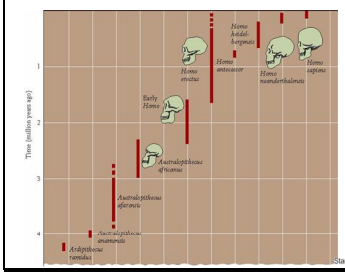
Stanley, 2005, Freeman

## Razvoj čovjeka

- miocenski čovjekoliki majmuni imali snažnu radijaciju
- najraniji čovjekoliki majmuni

Stanley, 2005, Freeman

## Razvoj čovjeka




## Razvoj čovjeka

- **australopitekus**
  - **prijelazni oblik između čovjekolikih majmuna i čovjeka**

**Australopithecus** **Rani Homo** **Homo erectus**

Stanley, 2005, Freeman

## Razvoj čovjeka

- **otisci australopitekusa pokazuju dvonožno kretanje**

Stanley, 2005, Freeman

## Razvoj čovjeka

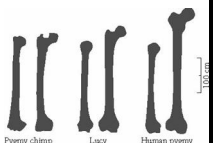
- blago savinute kosti prstiju pokazuju da se australopitekus uspinjao uz drvo

Stanley, 2005, Freeman

## Razvoj čovjeka

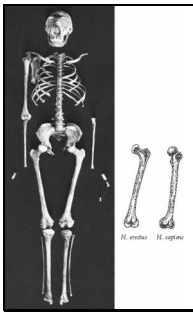

- *Homo*
  - *2,4 mil. god.*

**Australopithecus**




Stanley, 2005, Freeman

## Razvoj čovjeka





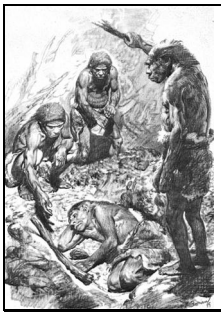

- **1,6 mil. god. dječak**
  - **Afrika**

Stanley, 2005, Freeman

## Razvoj čovjeka

- neandertalci
  - *Homo heidelbergensis*
    - Heidelberg
  - *Homo neanderthalensis krapinensis*
    - *Dragutin Gorjanović Kramberger*
  - Vindija
    - jedni od najmladih u Europi

Stanley, 2005, Freeman

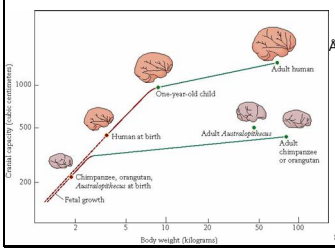


## Razvoj čovjeka

- grobovi neandertalaca
  - glava položena na ruku
  - moguće religiozni

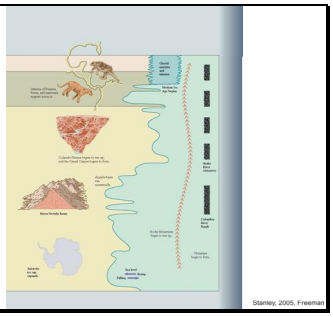
Stanley, 2005, Freeman

## Razvoj čovjeka

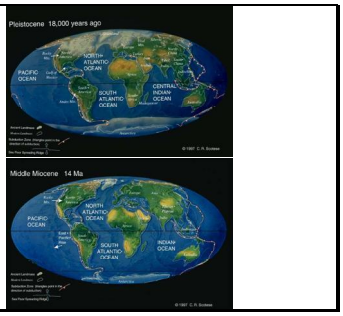


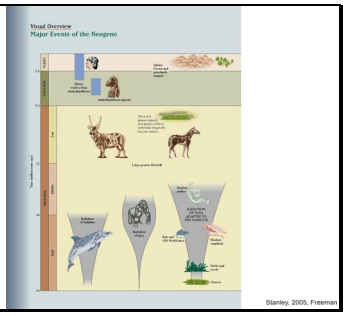

- rast mozga kod primata

Stanley, 2005, Freeman



Stanley, 2005, Freeman




Stanley, 2005, Freeman