STRATIGRAPHIE SEQUENTIELLE (SUITE)

Stratigraphical record vs. geological time

- **Lithostratigraphy:**
  Same/similar lithology: grouped together
- **Walther's Law:**
  Units are diachronous: biostratigraphy

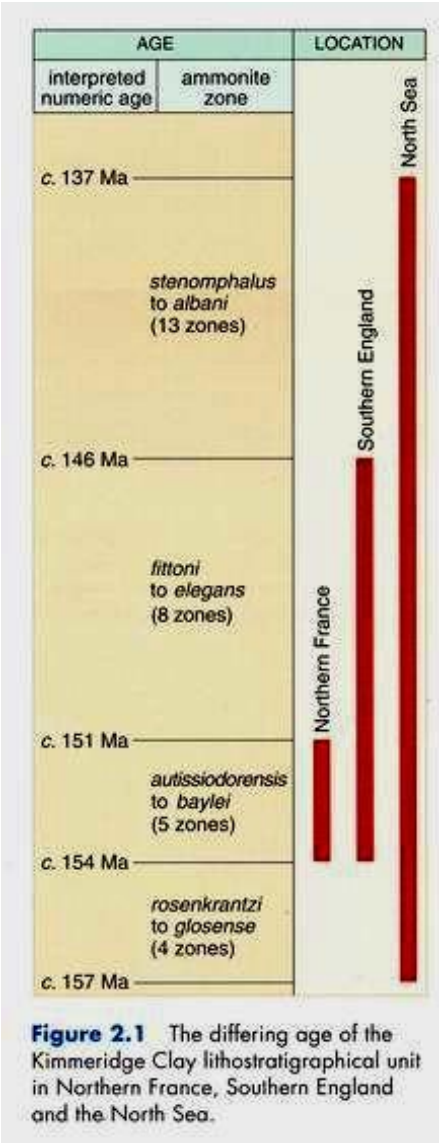
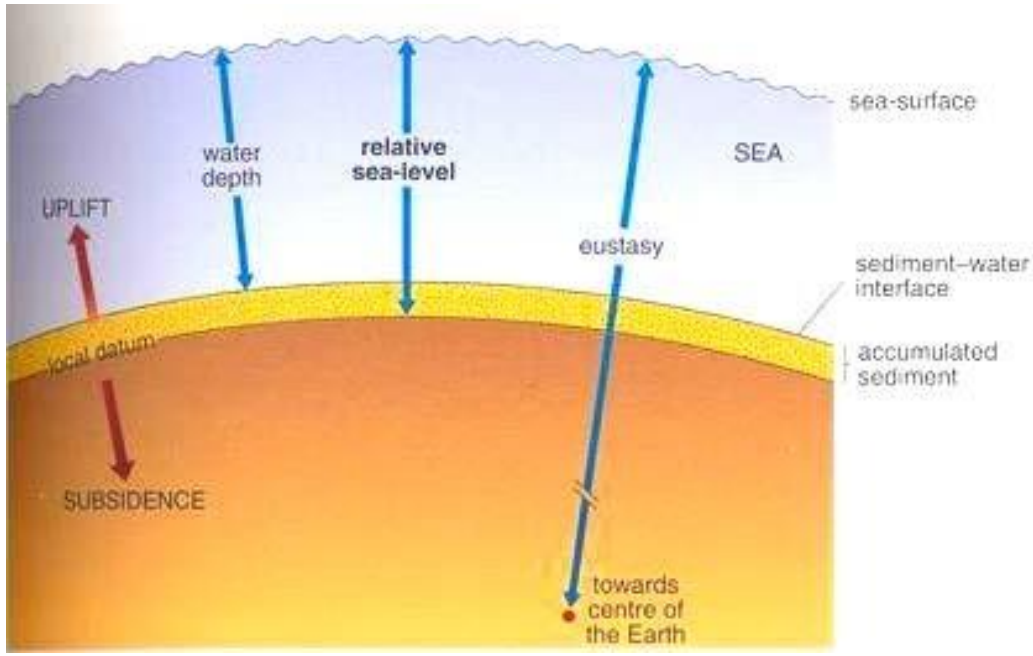


Figure 2.1 The differing age of the Kimmeridge Clay lithostratigraphical unit in Northern France, Southern England and the North Sea.

Sea-level change

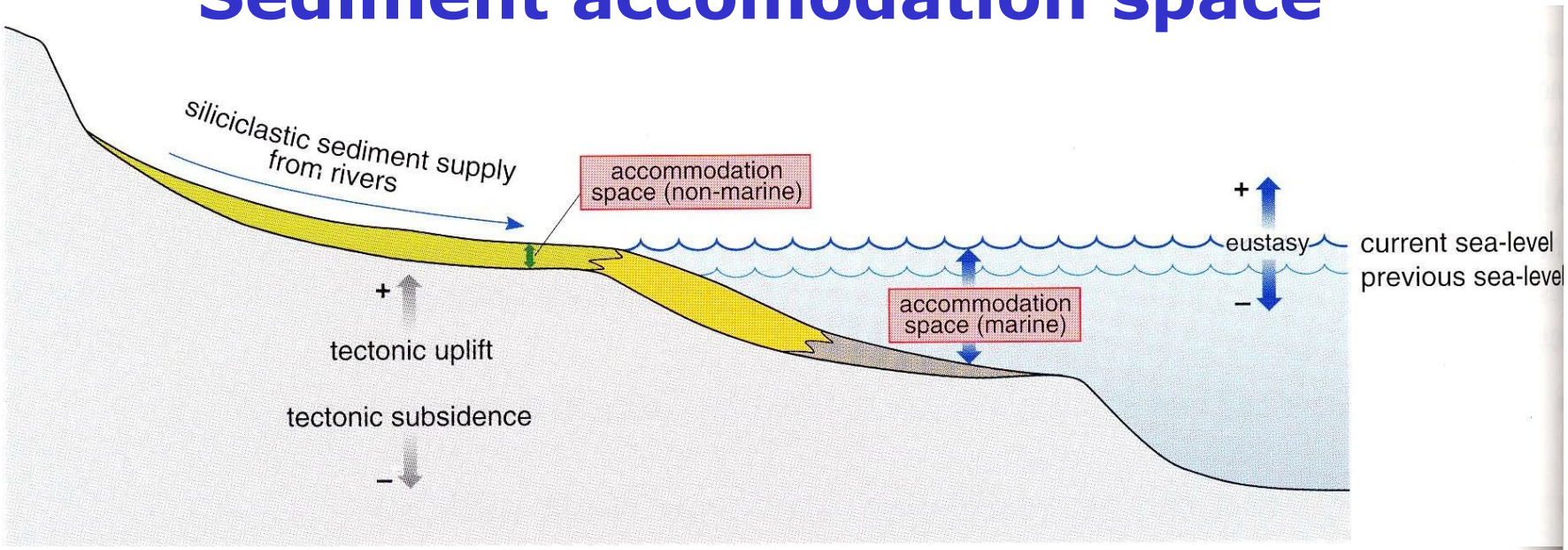
- eustasy

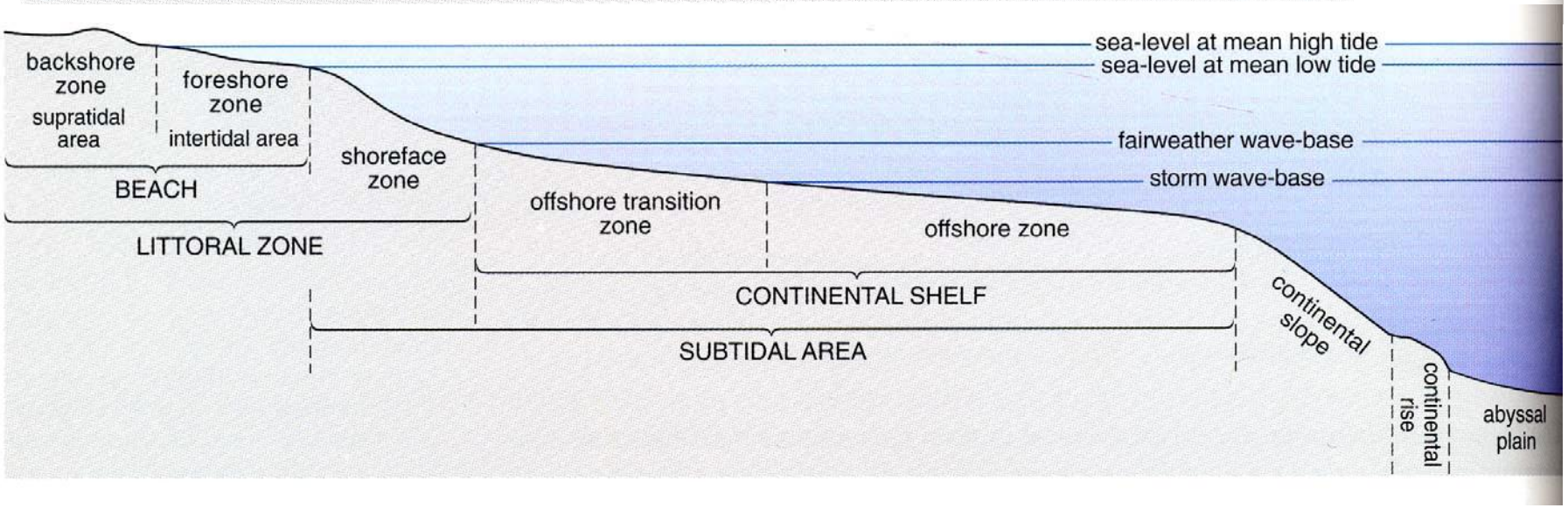
vs. relative sea-level; ΔV



- Interpretation: sequence stratigraphy model, cycles : 10ka - >50Ma
  - genetic approach, genetic units
  - packages of strata are bounded by chronostratigraphical units
    - unconformities [gaps] (relative sea-level fall)
    - flooding surfaces (relative sea-level rise)

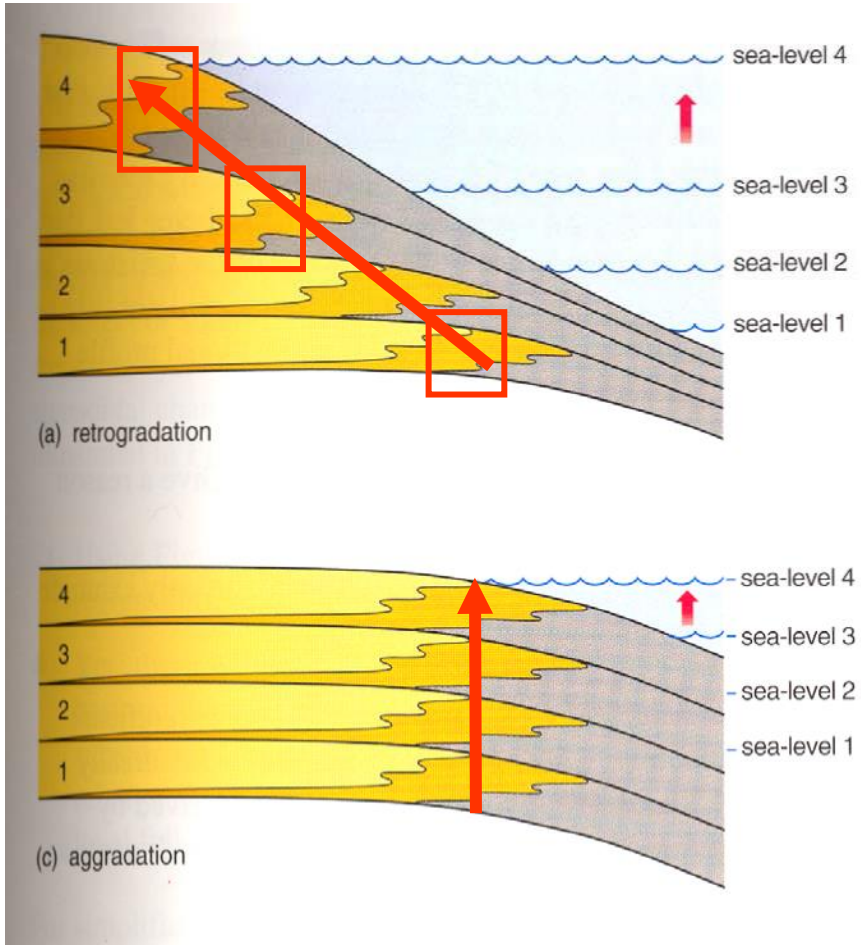
Sediment accomodation space



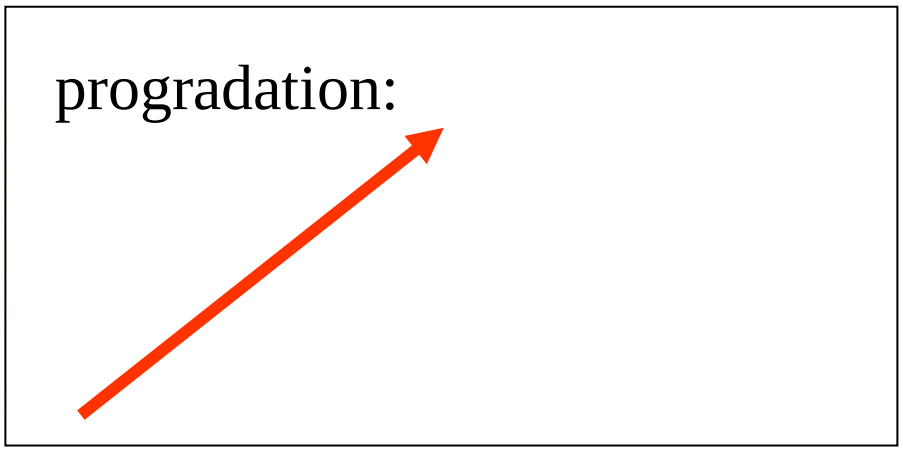


Development of parasequences

- **sea-level + accomodations space + sediment supply**
  - variations over a number of different time-scales
- **Small-scale units: balance between sediment supply and accomodation space**



progradation:

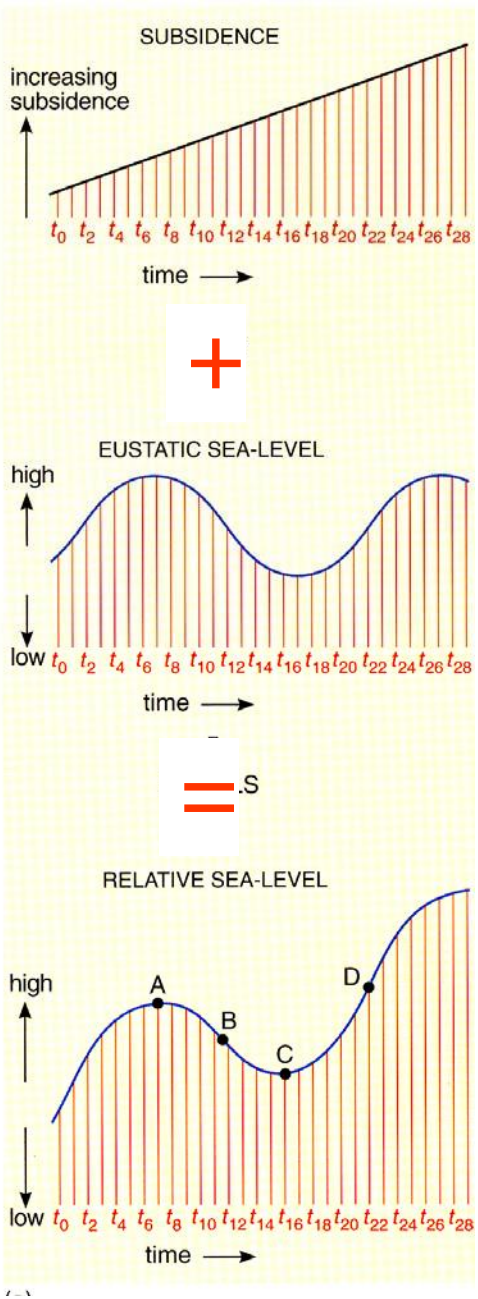


KEY

alluvial and coastal plain sediments

shallow-marine sediments

offshore-marine sediments

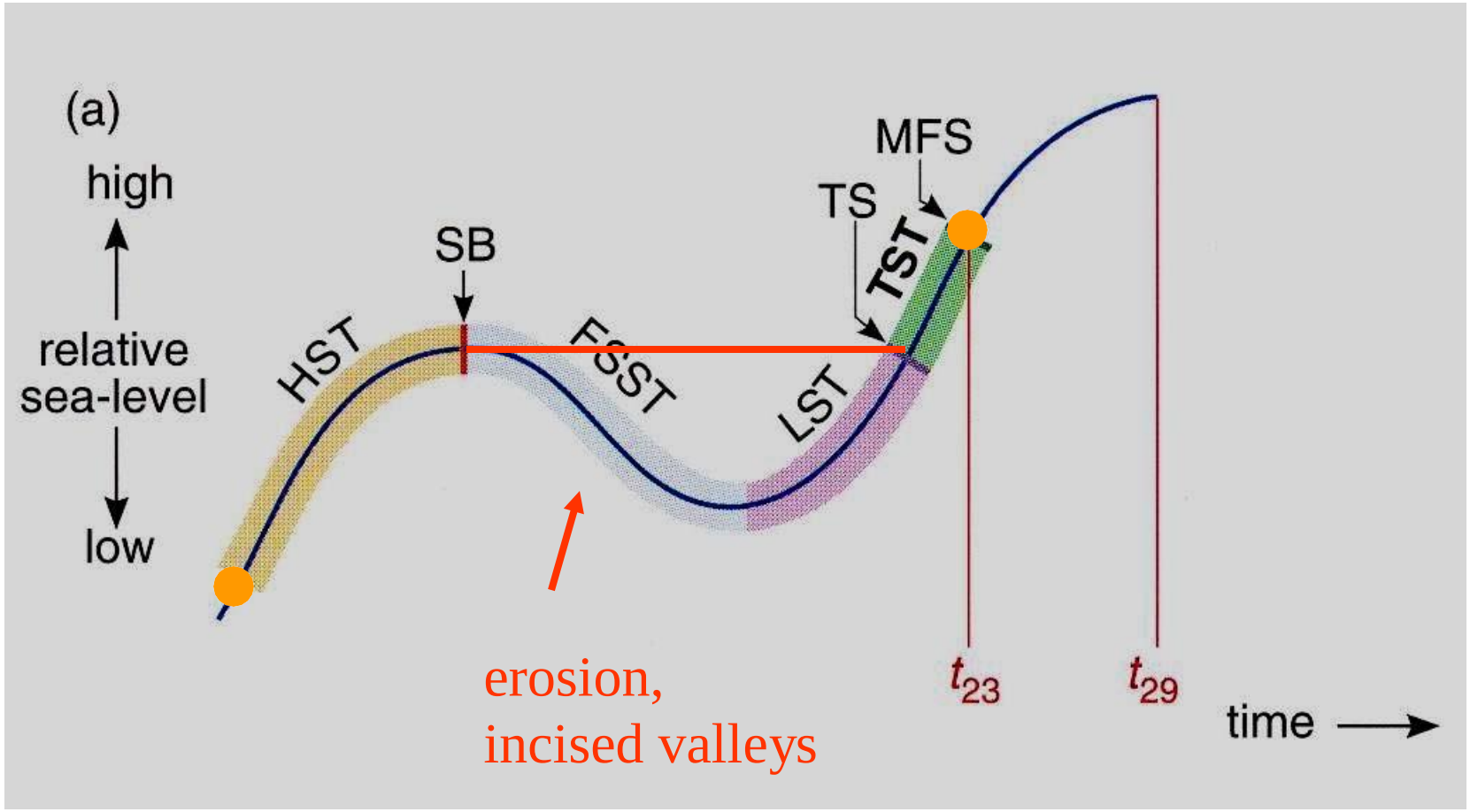


Sequences and systems tracts

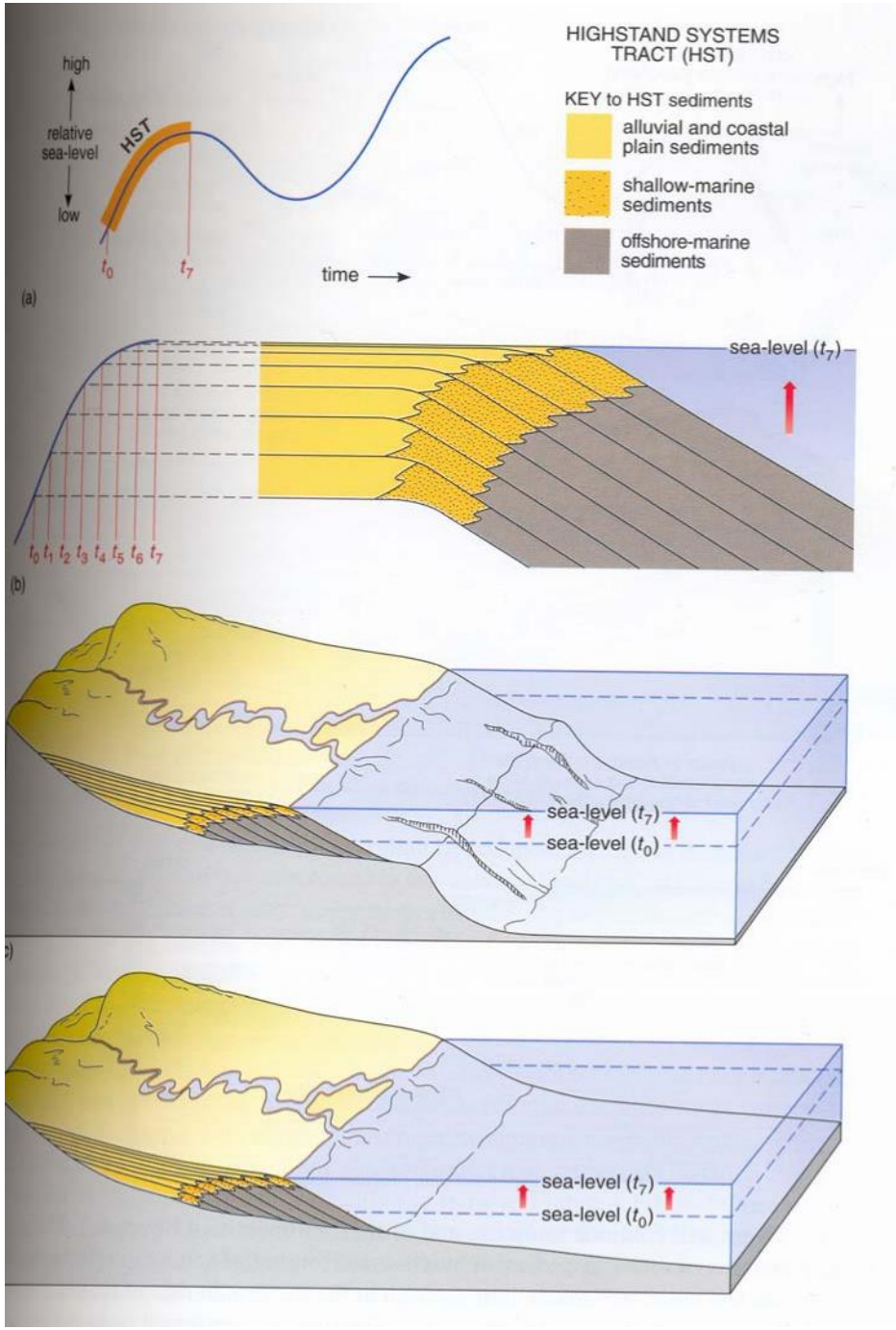
- **depositional sequence:**
  succession of parasequence sets

- **each sequence:**
  - o one cycle: balance between accom. space & sediment

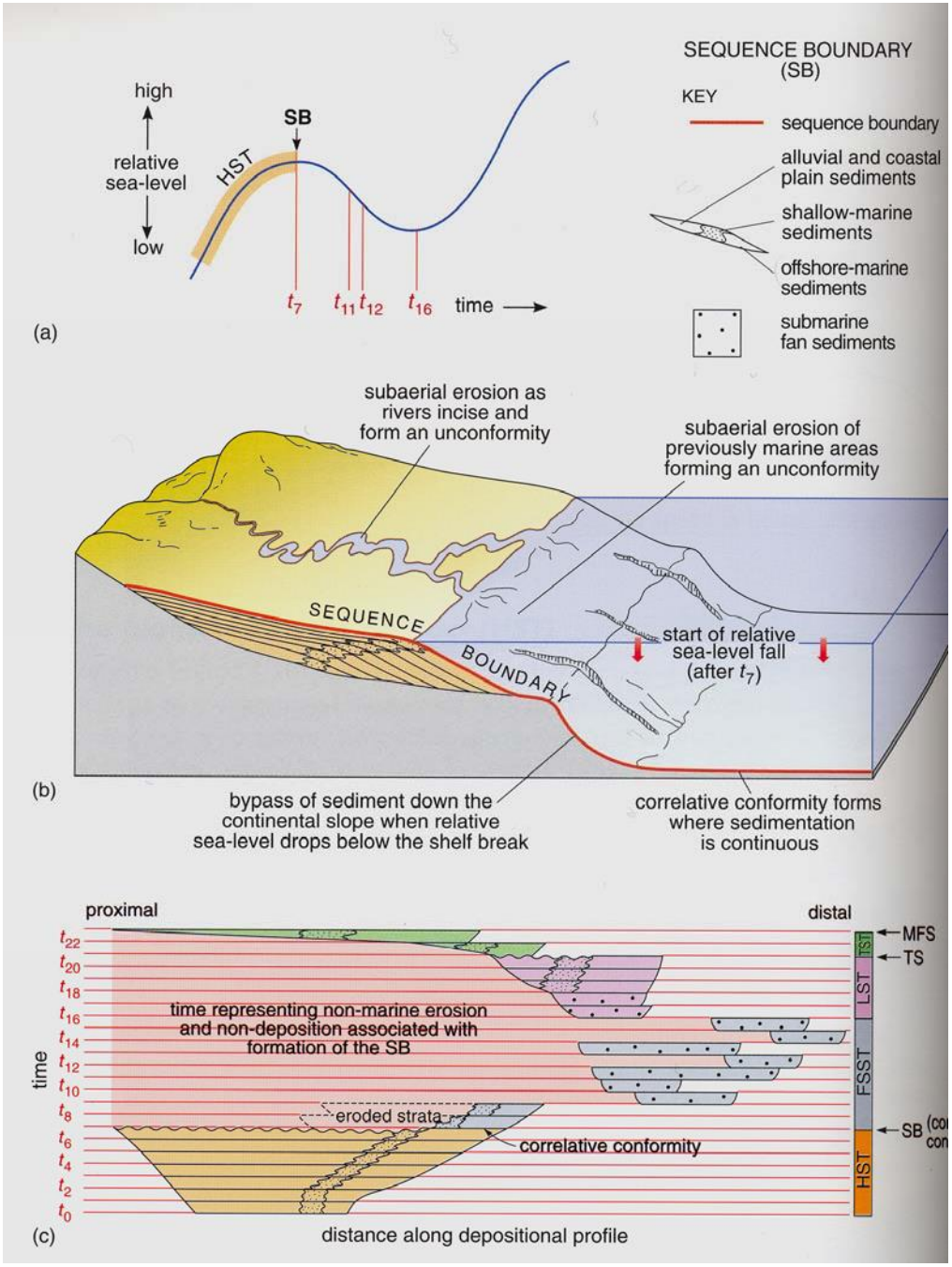
  - o built up by up to 4 **systems tracts,** each st.: at least one parasequence set


(a)
high
relative
sea-level
low
HST
SB
FSST
LST
TS
TST
MFS
erosion,
incised valleys
t_{23}
t_{29}
time

HST

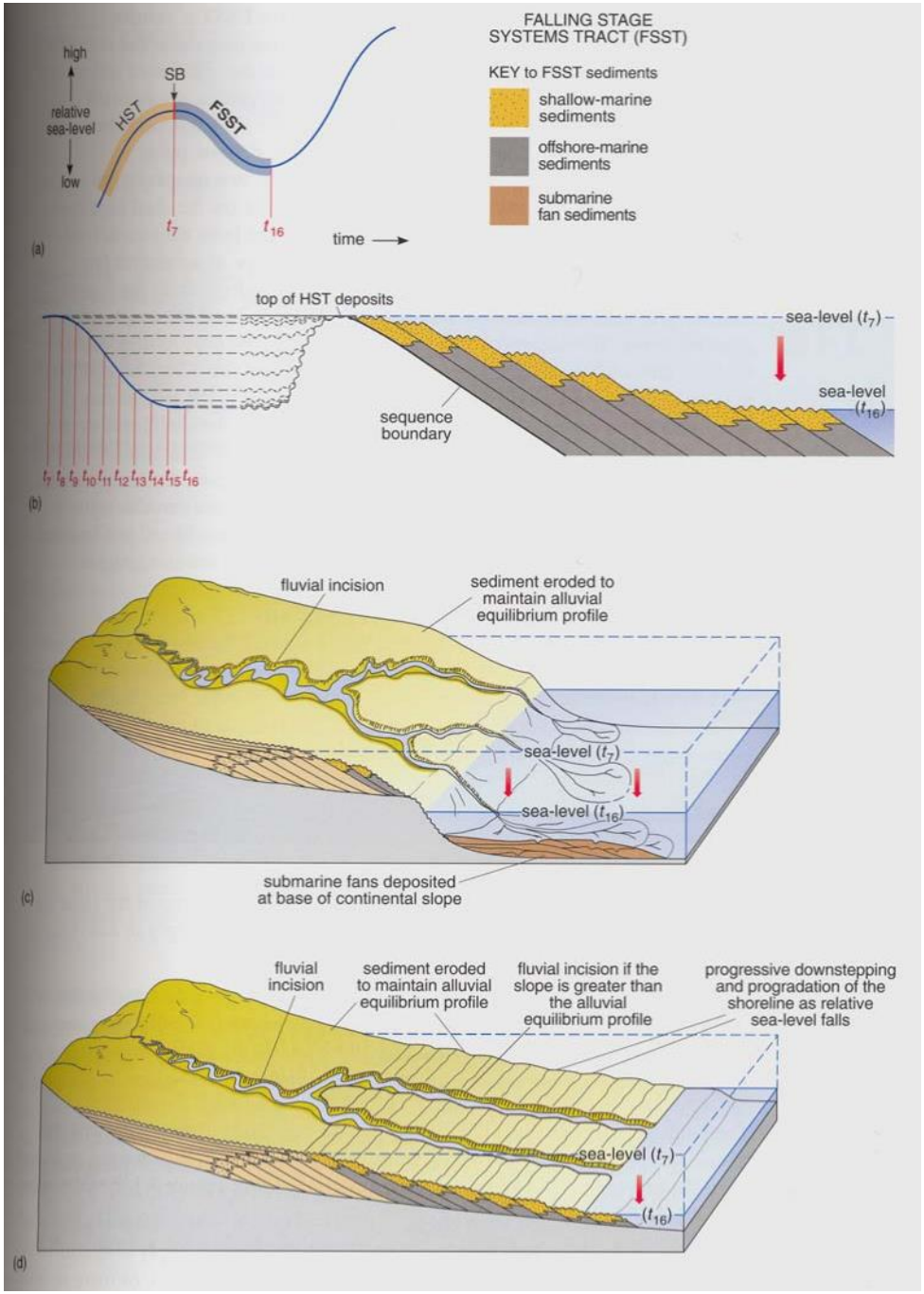

HIGHSTAND SYSTEMS TRACT (HST)
KEY to HST sediments
alluvial and coastal plain sediments
shallow-marine sediments
offshore-marine sediments
high
relative sea-level
low
HST
t_0
t_7
time
(a)
sea-level (t_7)
t_0 t_1 t_2 t_3 t_4 t_5 t_6 t_7
(b)
sea-level (t_7)
sea-level (t_0)
sea-level (t_7)
sea-level (t_0)

SB

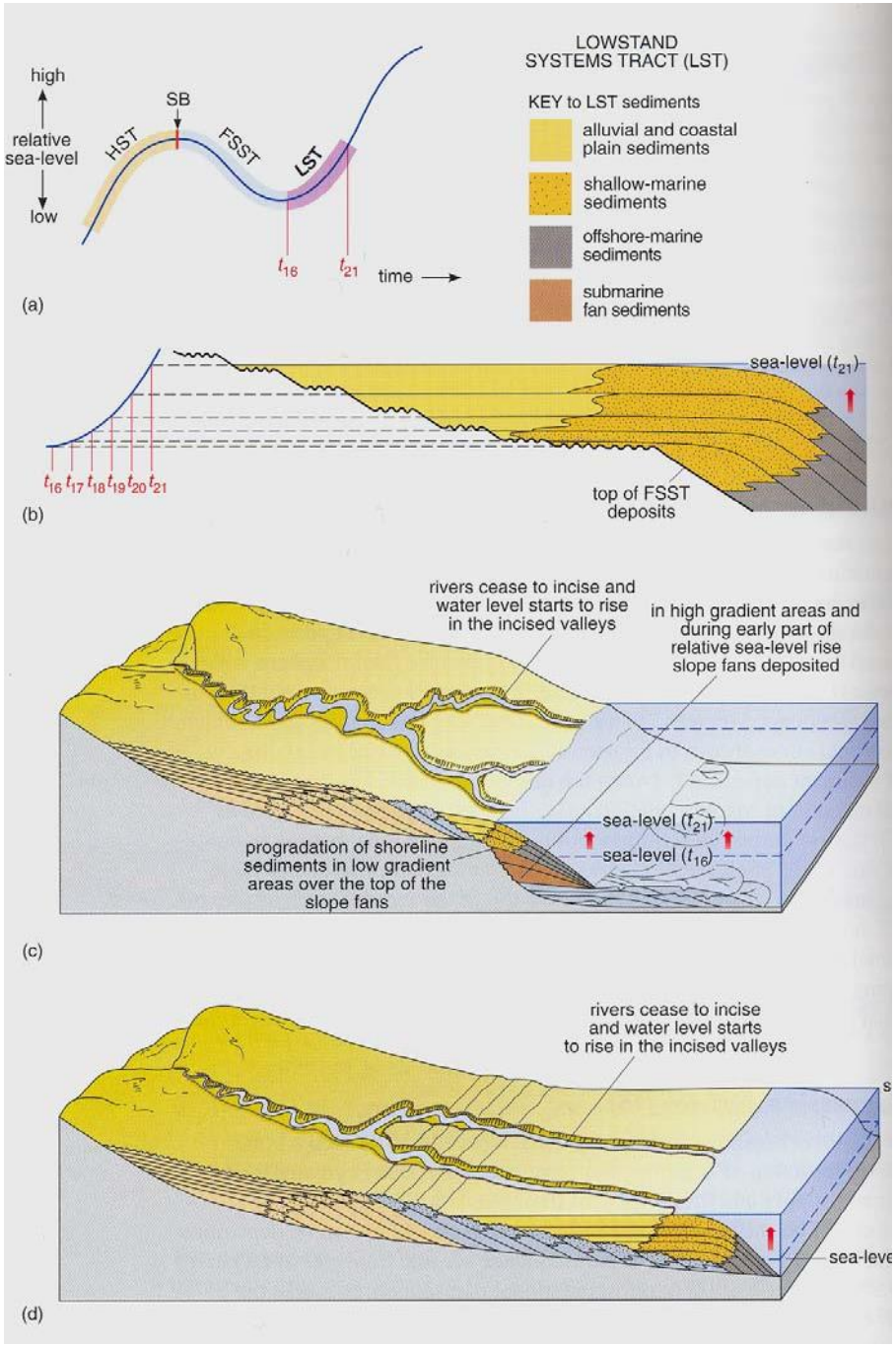

SEQUENCE BOUNDARY (SB)
KEY
sequence boundary
alluvial and coastal plain sediments
shallow-marine sediments
offshore-marine sediments
submarine fan sediments
high
relative sea-level
low
SB
HST
t_7 t_{11} t_{12} t_{16} time
(a)
subaerial erosion as rivers incise and form an unconformity
subaerial erosion of previously marine areas forming an unconformity
SEQUENCE BOUNDARY
start of relative sea-level fall (after t_7)
(b)
bypass of sediment down the continental slope when relative sea-level drops below the shelf break
correlative conformity forms where sedimentation is continuous
proximal
distal
time
t_{22} t_{20} t_{18} t_{16} t_{14} t_{12} t_{10} t_8 t_6 t_4 t_2 t_0
time representing non-marine erosion and non-deposition associated with formation of the SB
eroded strata
correlative conformity
TST
LST
FSST
HST
MFS
TS
SB
(c)
distance along depositional profile

FSST: Falling stage systems tract

- lost of accomodation space

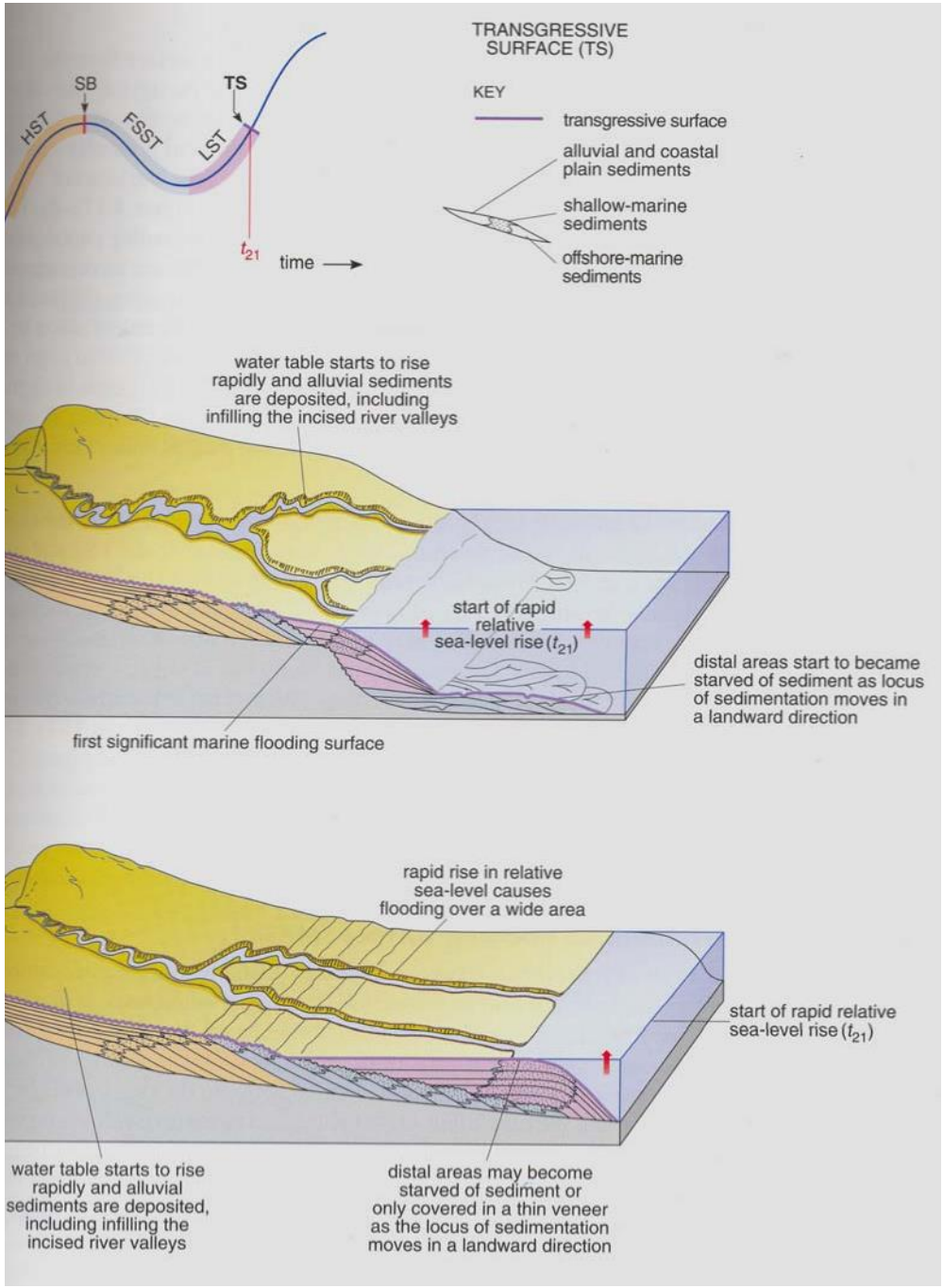


LST

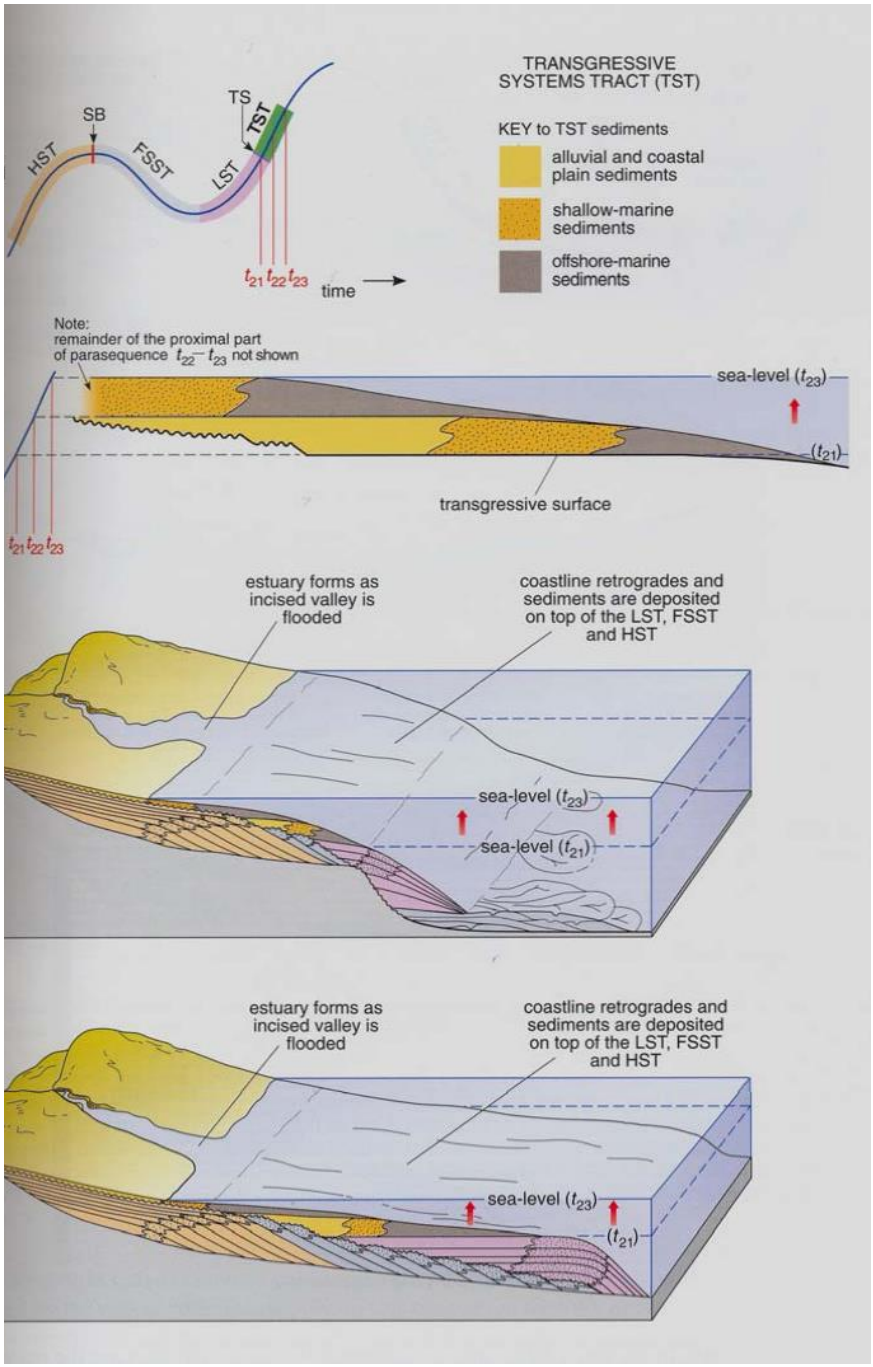

LOWSTAND
SYSTEMS TRACT (LST)
KEY to LST sediments
alluvial and coastal plain sediments
shallow-marine sediments
offshore-marine sediments
submarine fan sediments
high
relative sea-level
low
SB
HST
FSST
LST
t_{16}
t_{21}
time
(a)
sea-level (t_{21})
t_{16} t_{17} t_{18} t_{19} t_{20} t_{21}
top of FSST deposits
(b)
rivers cease to incise and water level starts to rise in the incised valleys
in high gradient areas and during early part of relative sea-level rise slope fans deposited
sea-level (t_{21})
sea-level (t_{16})
progradation of shoreline sediments in low gradient areas over the top of the slope fans
(c)
rivers cease to incise and water level starts to rise in the incised valleys
sea-leve
(d)

Transgressive Surface

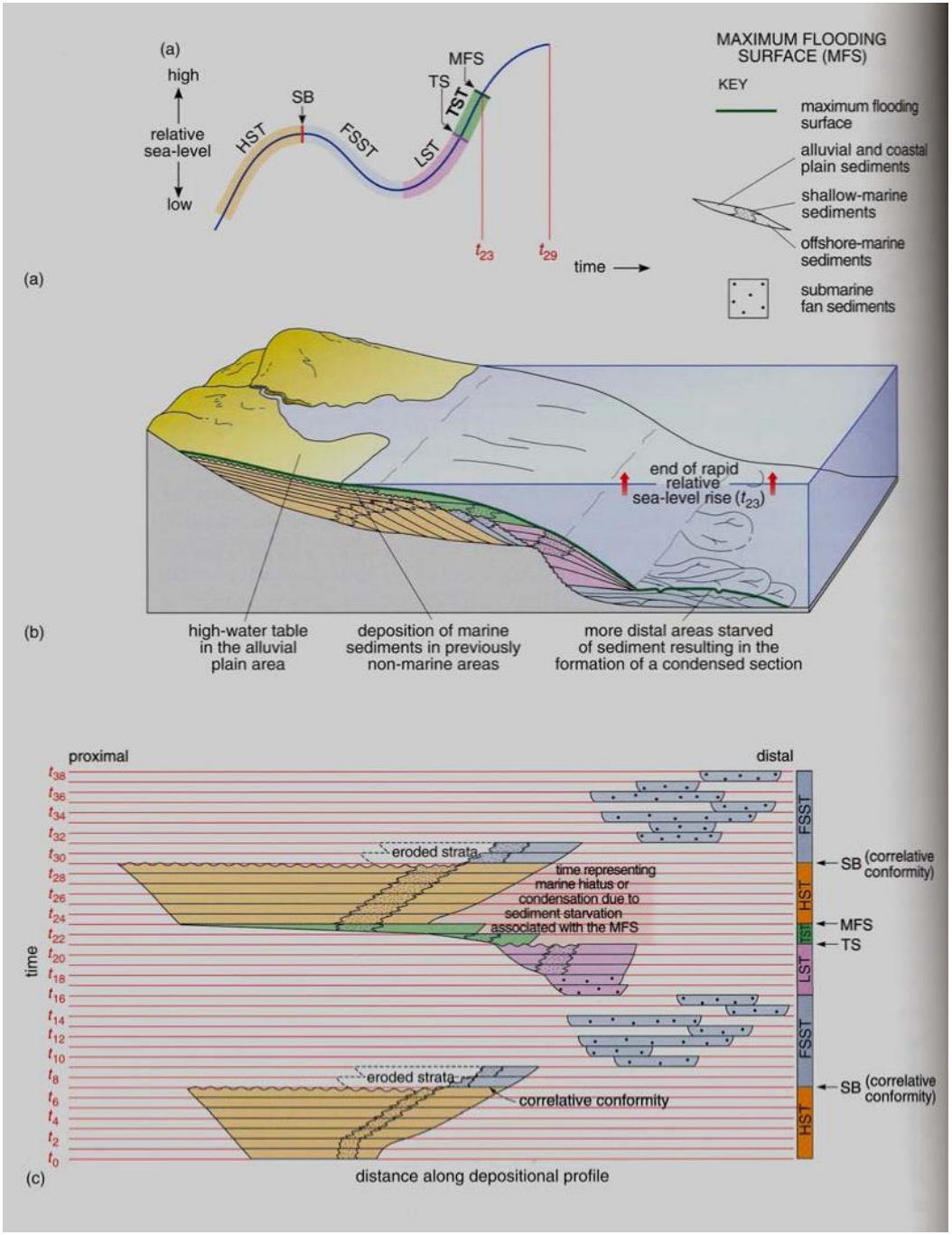
- creation of accomo-dation space > rate of sediment supply



TST


TRANSGRESSIVE
SYSTEMS TRACT (TST)
KEY to TST sediments
alluvial and coastal plain sediments
shallow-marine sediments
offshore-marine sediments
HST
SB
FSST
LST
TS
TST
t_{21} t_{22} t_{23}
time
Note:
remainder of the proximal part
of parasequence t_{22}–t_{23} not shown
sea-level (t_{23})
(t_{21})
transgressive surface
estuary forms as incised valley is flooded
coastline retrogrades and sediments are deposited on top of the LST, FSST and HST
sea-level (t_{23})
sea-level (t_{21})
estuary forms as incised valley is flooded
coastline retrogrades and sediments are deposited on top of the LST, FSST and HST
sea-level (t_{23})
(t_{21})

MFS


(a)
high
relative sea-level
low
HST
SB
FSST
LST
TS
TST
MFS
t_{23}
t_{29}
time
MAXIMUM FLOODING SURFACE (MFS)
KEY
maximum flooding surface
alluvial and coastal plain sediments
shallow-marine sediments
offshore-marine sediments
submarine fan sediments
(a)
end of rapid relative sea-level rise (t_{23})
high-water table in the alluvial plain area
deposition of marine sediments in previously non-marine areas
more distal areas starved of sediment resulting in the formation of a condensed section
(b)
proximal
distal
time
t_{38} t_{36} t_{34} t_{32} t_{30} t_{28} t_{26} t_{24} t_{22} t_{20} t_{18} t_{16} t_{14} t_{12} t_{10} t_8 t_6 t_4 t_2 t_0
eroded strata
time representing marine hiatus or condensation due to sediment starvation associated with the MFS
eroded strata
correlative conformity
FSST
HST
TST
LST
FSST
HST
SB (correlative conformity)
MFS
TS
SB (correlative conformity)
(c)
distance along depositional profile