Sedimentary Facies Analysis of Miocene Clastic Strata in Kalewa-Mawleik Area, Sagaing Region, Myanmar*

Moe Zat[1] and Day Wa Aung[2]

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Abstract

The present study would offer the Sedimentary Facies of Miocene clastic sedimentary rock units of Letkat Formation (Early Miocene), Natma Formation (Middle Miocene) and Shwethamin Formation (Late Miocene) exposed in the southwestern Chindwin Basin, situated in Kalewa-Mawleik Townships, Sagaing Region, Myanmar. The study is mainly focus on outcrop-based sedimentary facies analysis. During Early Miocene, Letkat Formation was deposited in a fluvial-river system of the lowstand systems tract deposits (LST) deeply incised into the underlying Yaw Formation during relative sea-level fall, also be regarded as an incised fluvial channel-fill (IVF). The fluvial sequence of the lower part Letkat Formation is characterized by high bed-load gravelly and sandy, multi-story sand bodies of braided channel-complexes with general lack of the overbank fines. The middle part of the formation is constructed with the shallow and broad amalgamated sandy channels with thick laminated sheets (LS) probably deposited as a result of unconfined sheet flooding. The upper part is becoming dominated with thick overbank-floodplains fines (OF) interbedded with the isolated major channels, minor channels or crevasse channels, and thin crevasse splays or laminated sand sheets. The lower part Natma Formation is becoming dominated with thick overbank-floodplains fines (OF) interbedded with the isolated major channels, minor channels or crevasse channels, and thin crevasse splays or laminated sand sheets in the fluvial system. The upward change in sand-body architectures within the sequence and lateral interconnected and amalgamated channel and meander belt systems with poorly preserved floodplain deposits. The lower part of Shwethamin Formation is characterized by high bedload gravelly and sandy, multi-story sand bodies of braided channel-complexes. The middle part is constructed with the shallow and broad amalgamated sandy channels whereas the upper part is dominated with thick overbank-floodplains fines.

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OUTLINES

I. Introduction

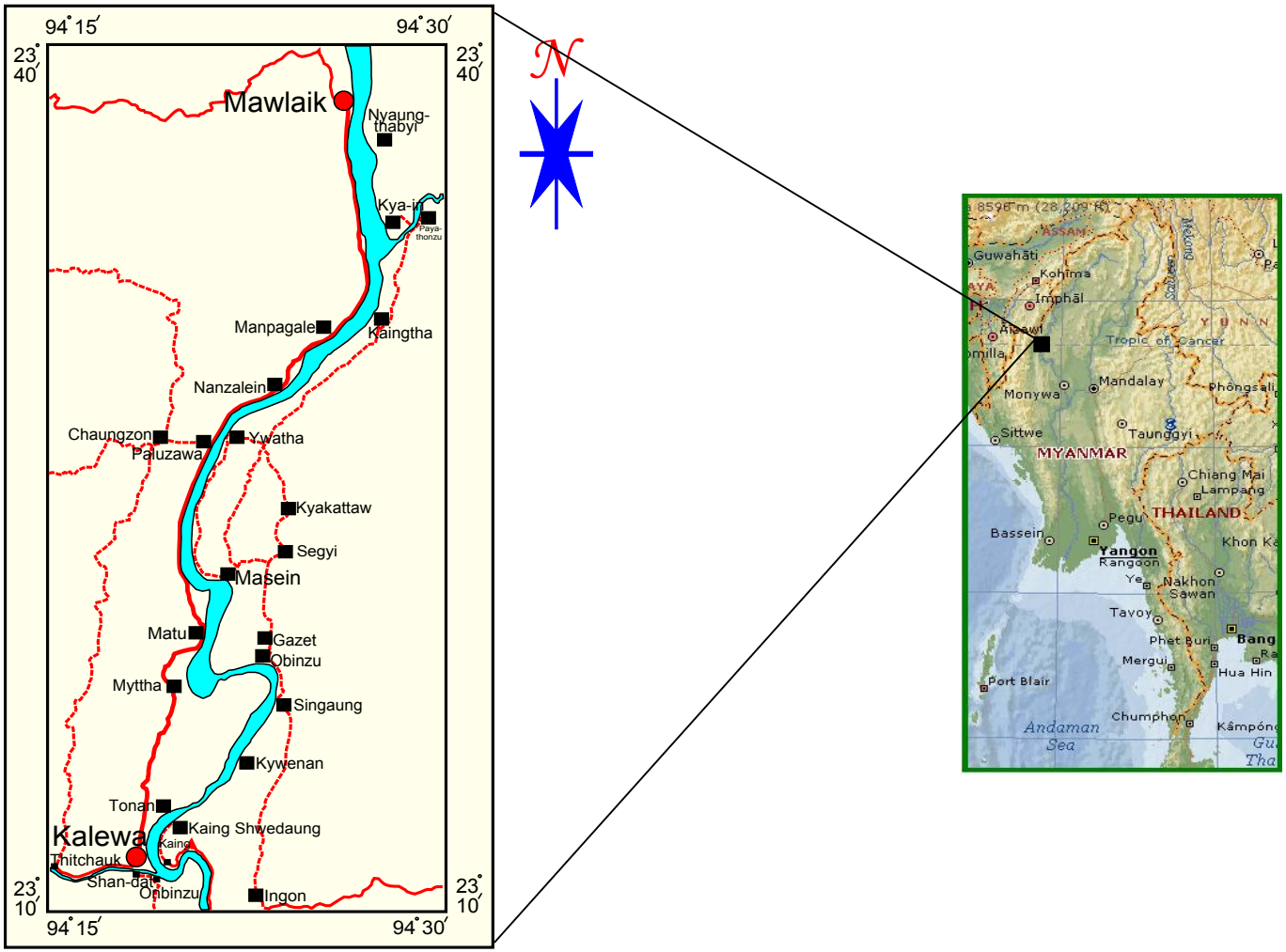
II. Stratigraphy

III. Sedimentary Facies Analysis

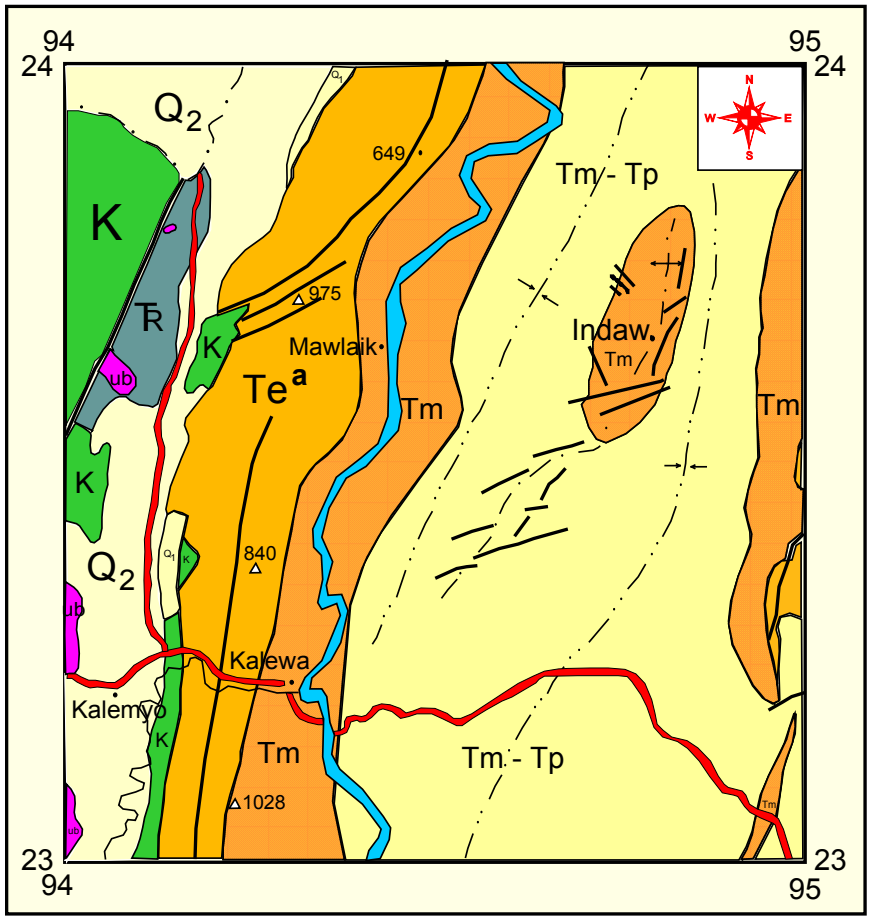
IV. Conclusion

I. Introduction

Location Map of the Study Area



Regional Geologic Setting



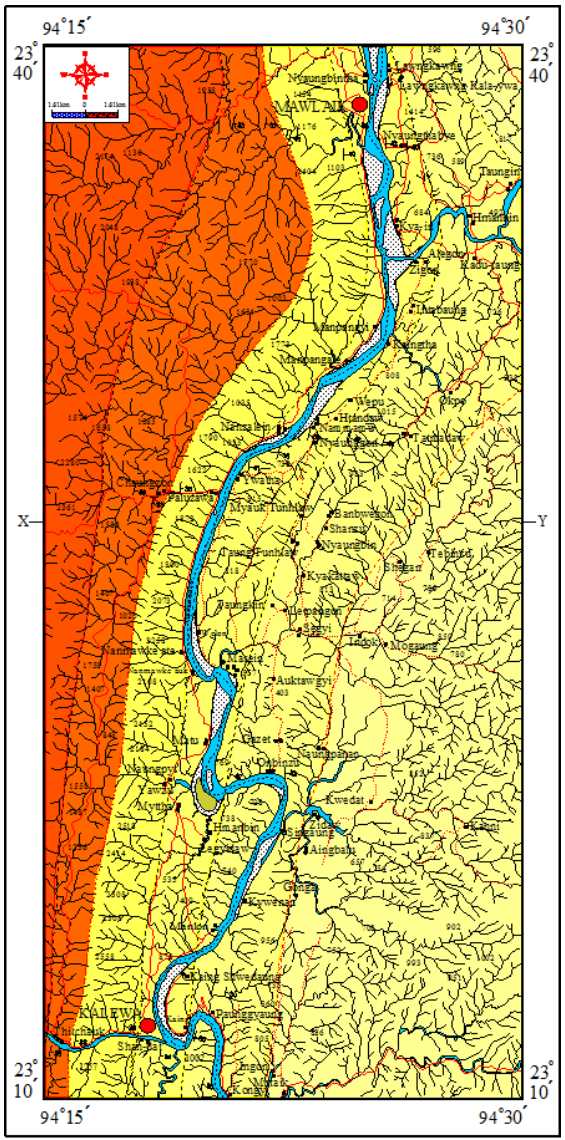
EXPLANATIONS

Q_2	HOLOCENE	Alluvium
Q_1	PLEISTOCENE	Older Alluvium and Gravels
Tm-Tp	MIOCENE - PLIOCENE	Irrawaddy Formation and its equivalents
Tm	MIOCENE	Upper Pegu Group and its equivalents
Te^a	EOCENE	Molasse-type units (along Central Belts)
K	CRETACEOUS	Globotruncana - bearing Flysch units of Western Ranges and Orbitolina - bearing Limestones of Northern Burma
T̄R	TRIASSIC	Bawgyo Group, Kamawkala Limestone and their equivalents
ub	ULTRABASIC and BASIC INTRUSIVES (mainly PERIDOTITE) and (SERPENTINE) - (CRETACEOUS - EOCENE)	

Scale 1 : 100000

Regional geologic setting of the study area
(From Geological Map of Myanmar, 1977)

Distribution of Rock Units



EXPLANATION

LITHOLOGIC SYMBOLS

MIO - PLIO. — IR

Irrawaddy Formation
Thin to medium-bedded, coarse to gritty sandstones

Unconformity

Shwetamin Formation
Yellowish brown, friable, medium to coarse-grained, massive sandstone with quartz pebble conglomerat pockets or stringers

MIOCENE — ST

MIOCENE — NM

Natma Formation
Medium to thick-bedded, medium to coarse-grained, occassionally pebbly sandstones and clays interbedded

MIOCENE — LK

Letkat Formation
Nwa Taung Sandstone Member - Medium-grained sandstones with some shale intercalations or partings
Thitchauk Conglomerate Member - Quartz pebble conglomerate and clean quartzose sandstones

Unconformity

EOCENE — Y

Yaw Formation
Thick sequence of bluish grey nodular shale to thinly laminated silty shale and thin to medium-bedded, fine- grained, rippled sandstone

GEOLOGIC SYMBOLS

Graditional Contact

Unconformity

Dip and strike of beds

GEOGRAPHIC SYMBOLS

High Point

Car Road and Cart Track

Pagoda

Village

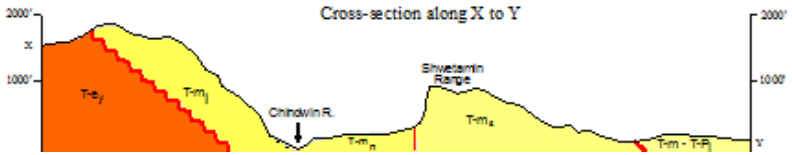
River and Stream

MAP INDEX

84 I/2	84 I/6	84 I/10
84 I/3	84 I/7	84 I/11
84 I/4	84 I/8	84 I/12

Study Area

Geology by Moe Zat, May 2014



II. Stratigraphy

Stratigraphic Sequences of Miocene Rocks in the Western Part of Southwestern Chindwin Basin, Kalewa-Mawleik Area

Age	Stratigraphic Units	Dominant Lithology	Maximum Thickness (m)	Depositional System
Late Miocene	Shwethamin Formation	Sand, minor silty shale	200	Fluvial system
Middle Miocene	Natma Formation	Shale, silty shale, minor sand	340	Fluvial system
Early Miocene	Letkat Formation	Sand, subordinate pebble-conglomerate, minor silt/clay	?	Fluvial system

Letkat Formation

- Mainly composed of the conglomerate and micaceous sandstones immediately overlying the Yaw Formation

Letkat Formation

Upper — Nwataung Sandstone Member

Lower — Thitchauk Conglomerate Member

Thitchauk Conglomerate Member

- Comprises quartz pebble conglomerate and clean quartzose sandstone.

Nwataung Sandstone Member

- Composed thin to massive, fine to medium-grained, yellowish to grey colored micaceous sandstones.

Natma Formation (Kalewa Formation)

- Comprises massive, medium to coarse-grained, occasionally pebbly sandstone and light color, softness and frequent development of ash gray and mottled clay and shale.

Shwethamin Formation

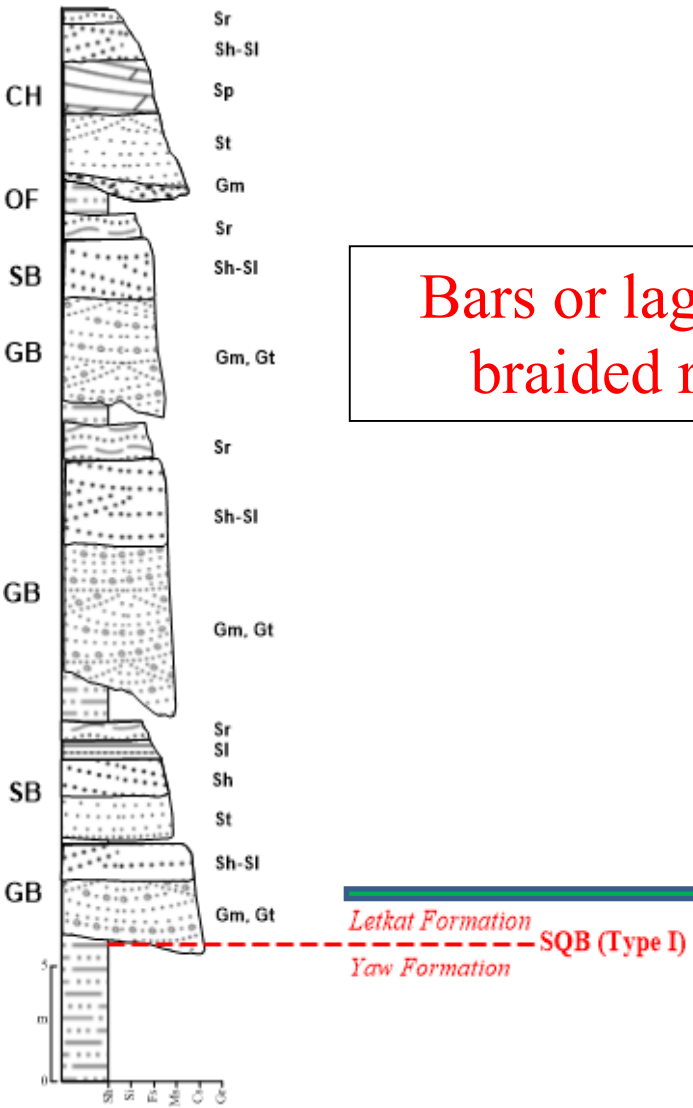
- Consisting of yellowish brown, friable, medium to coarse-grained, massive sandstone, occasionally interbedded with silty shale.

III. Sedimentary Facies Analysis

Lithofacies of Letkat Formation (Early Miocene)

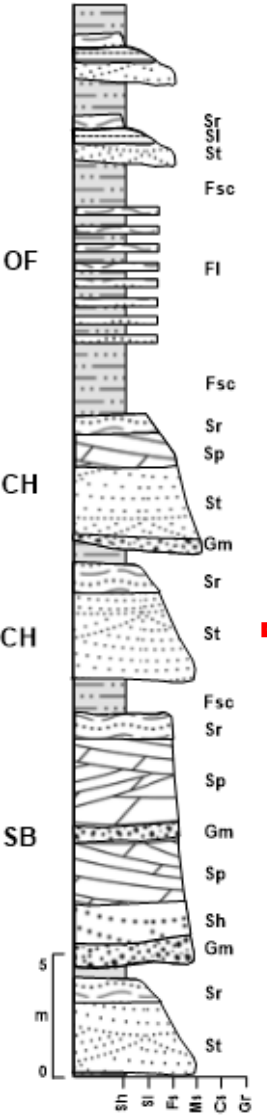
1. Trough cross-stratified sandstone (St) with basal erosional surface facies (Se)
2. Pebbly gritty sandstone facies (Gm)
3. Sand-mud interlayer facies (Fl)
4. Thinly laminated fine sandstone facies (Sl)
5. Planar cross-stratified sandstone facies (Sp)
6. Horizontal to low-angle stratified sandstone facies (Sh)
7. Bluish grey silty shale with silt and sand lens facies (Fsc)

1. Conglomeratic gritty sandstone facies (Gm)



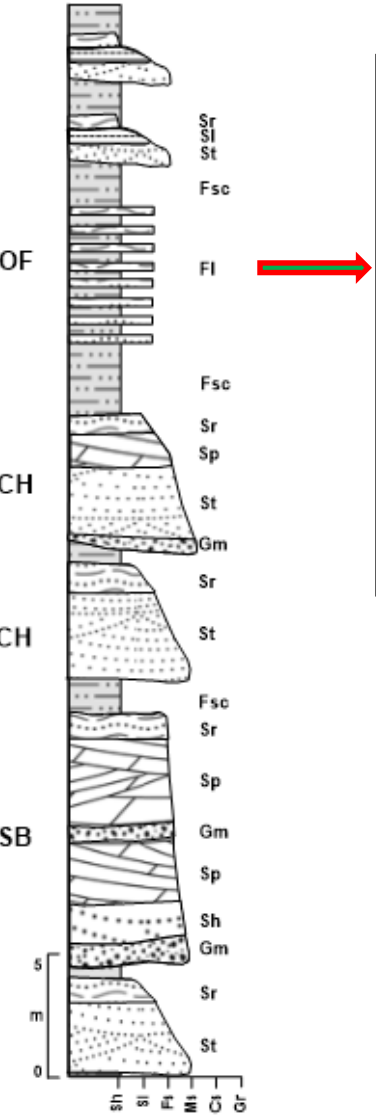
Bars or lag deposit of the braided river channel

2. Trough cross-stratified sandstone (St) facies



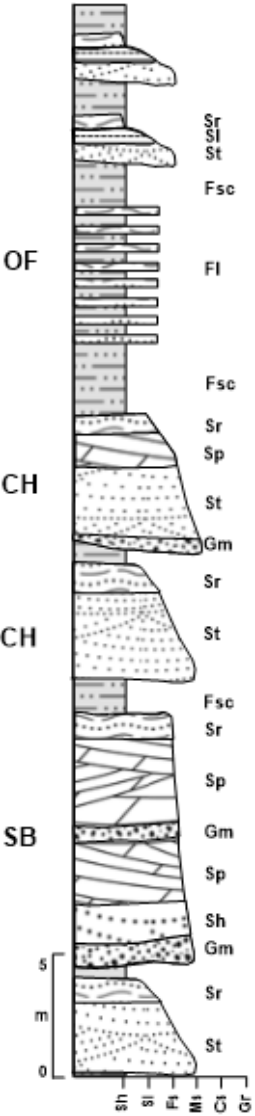
Channel deposit of braided river

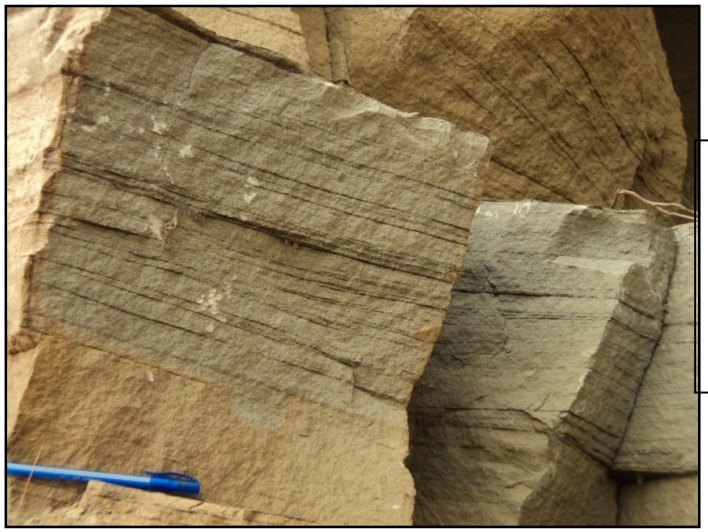
3. Sand-mud interlayer facies (Fl)



Overbank or waning flood deposit of fluvial channel

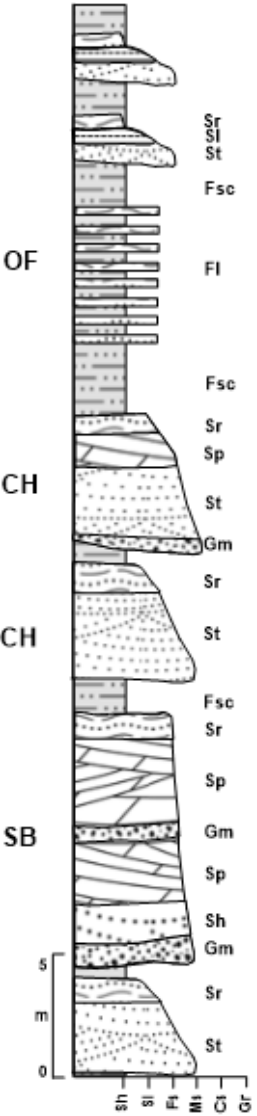
4. Thinly laminated fine sandstone facies (Sl)





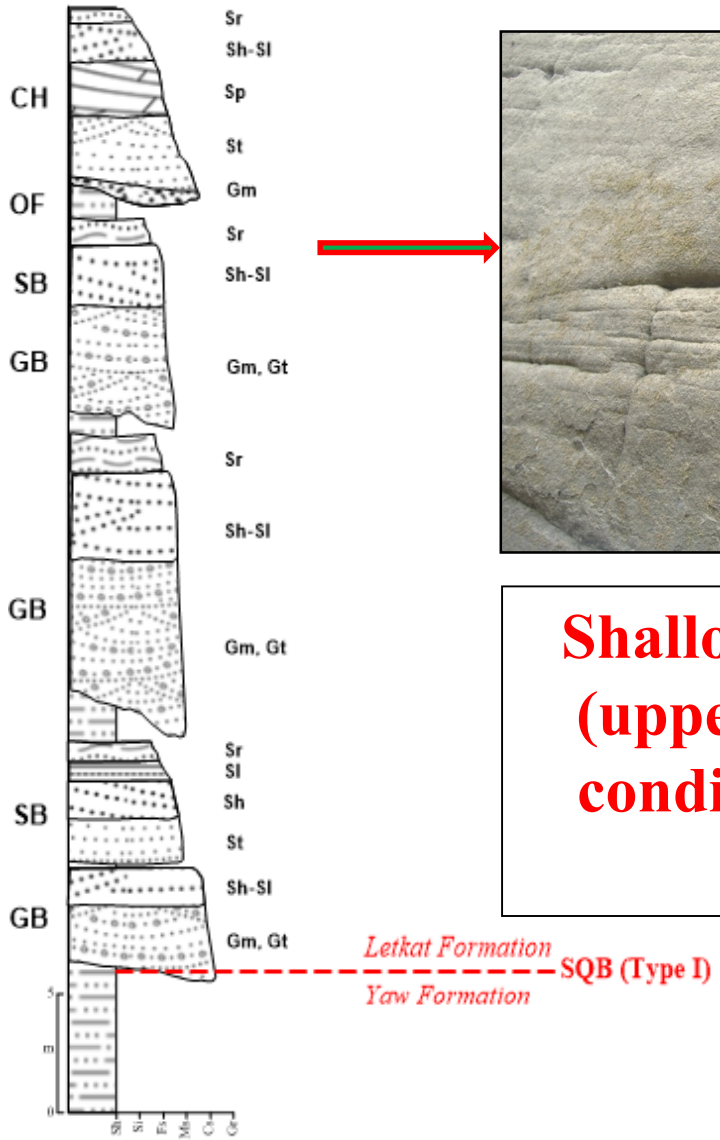
Planar bed flow (lower and upper flow regime) of fluvial channel

5. Planar cross-stratified sandstone facies (Sp)



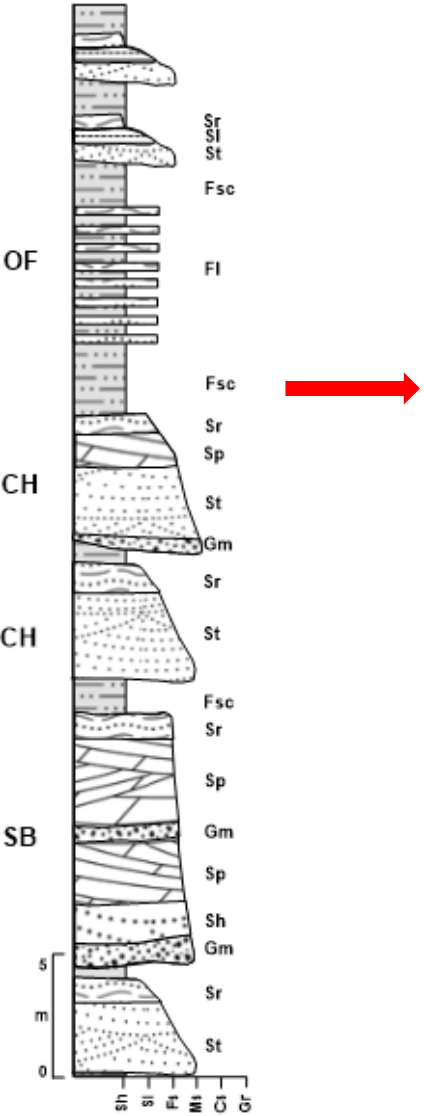
Transverse bars or dunes of fluvial channel

6. Horizontal to low-angle stratified sandstone facies (Sh-Sl)



Shallow, high-energy (upper flow regime) conditions of fluvial channel

7. Grey shale with silt and sand bands facies (Fsc)

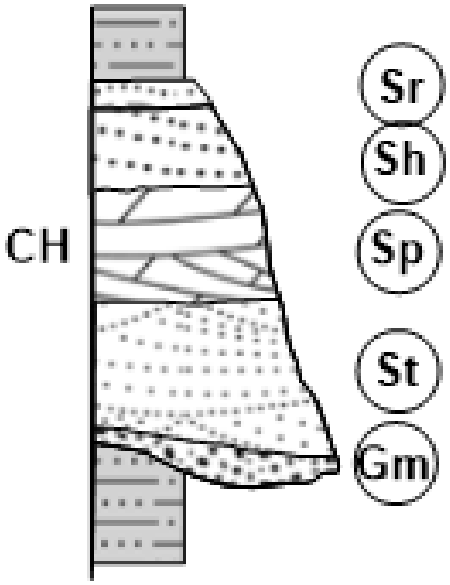


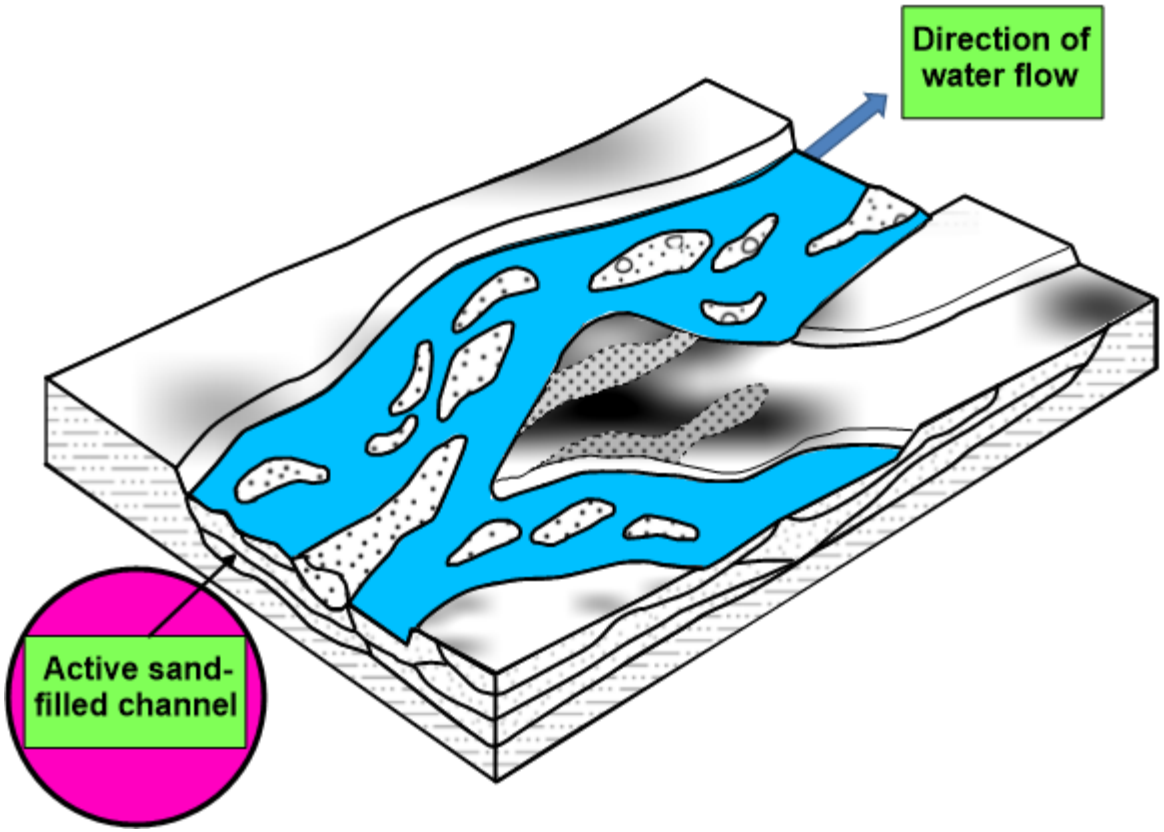
Overbank/ Floodfines

Lithofacies Association of Letkat Formation

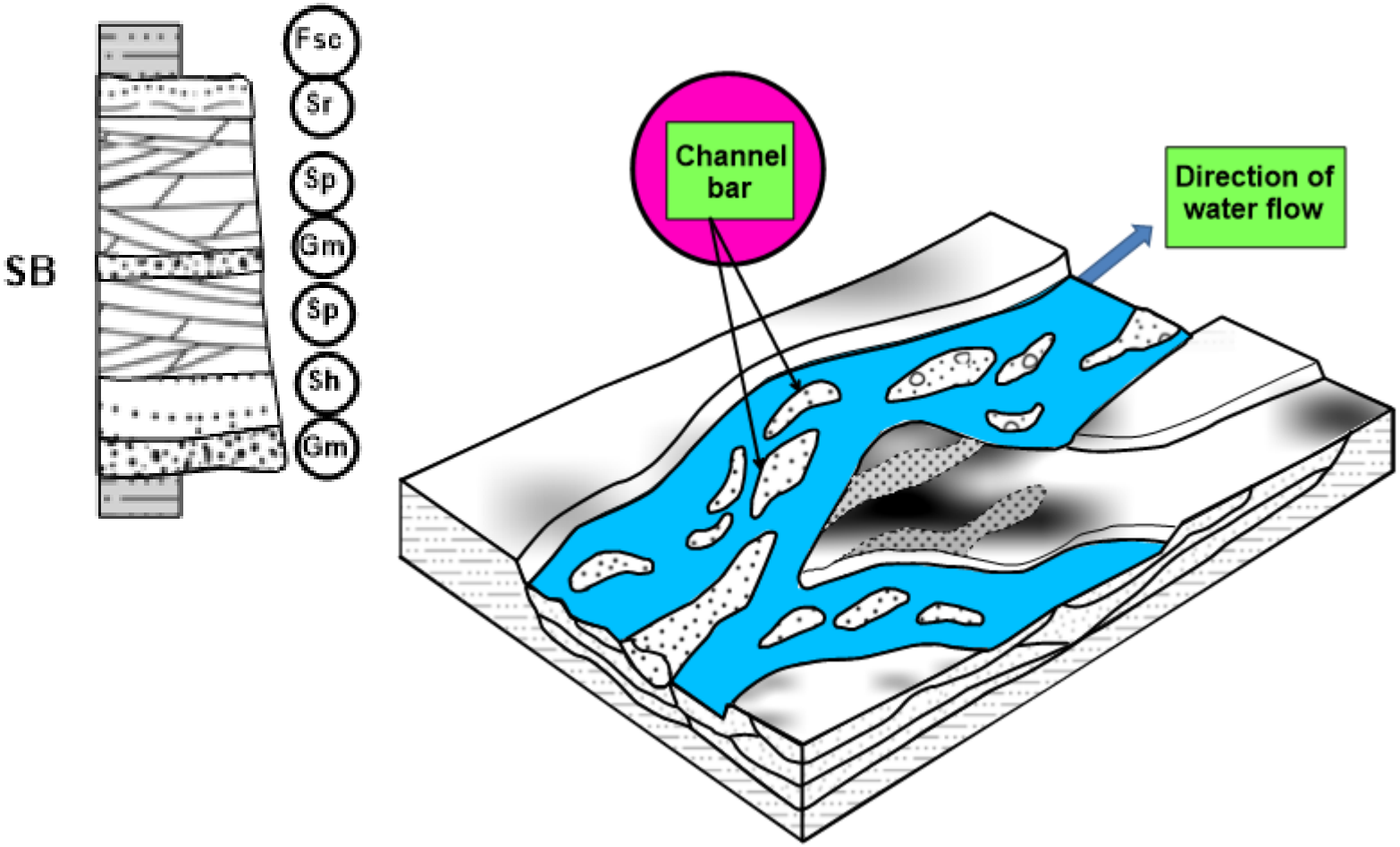
1. Sandy fluvial channel facies association (Ch)
2. Sand bar facies association (Sb)
3. Gravel bar facies association (Gb)
4. Overbank/flood fines facies association (OF)

1. Sandy fluvial channel facies association (Ch)

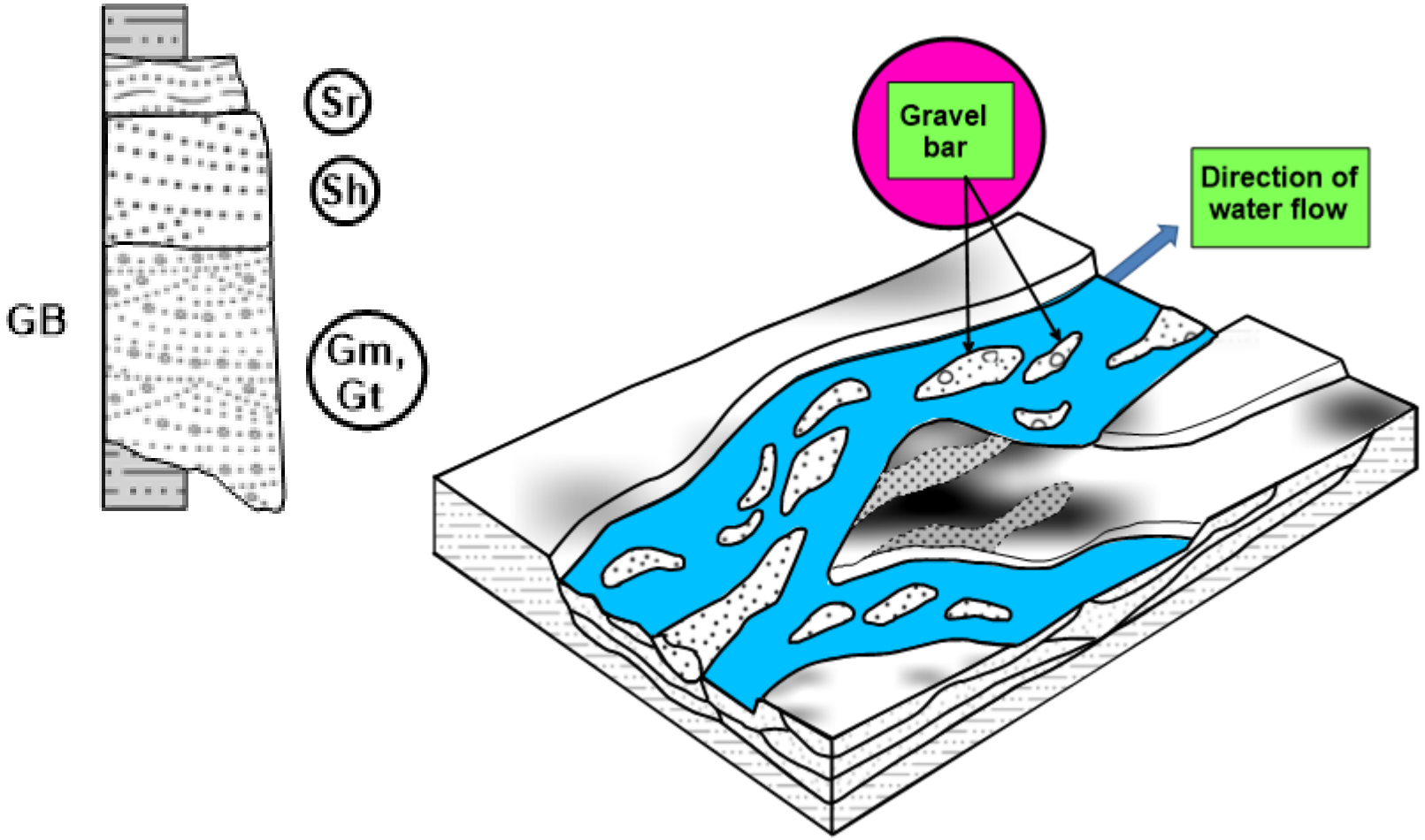




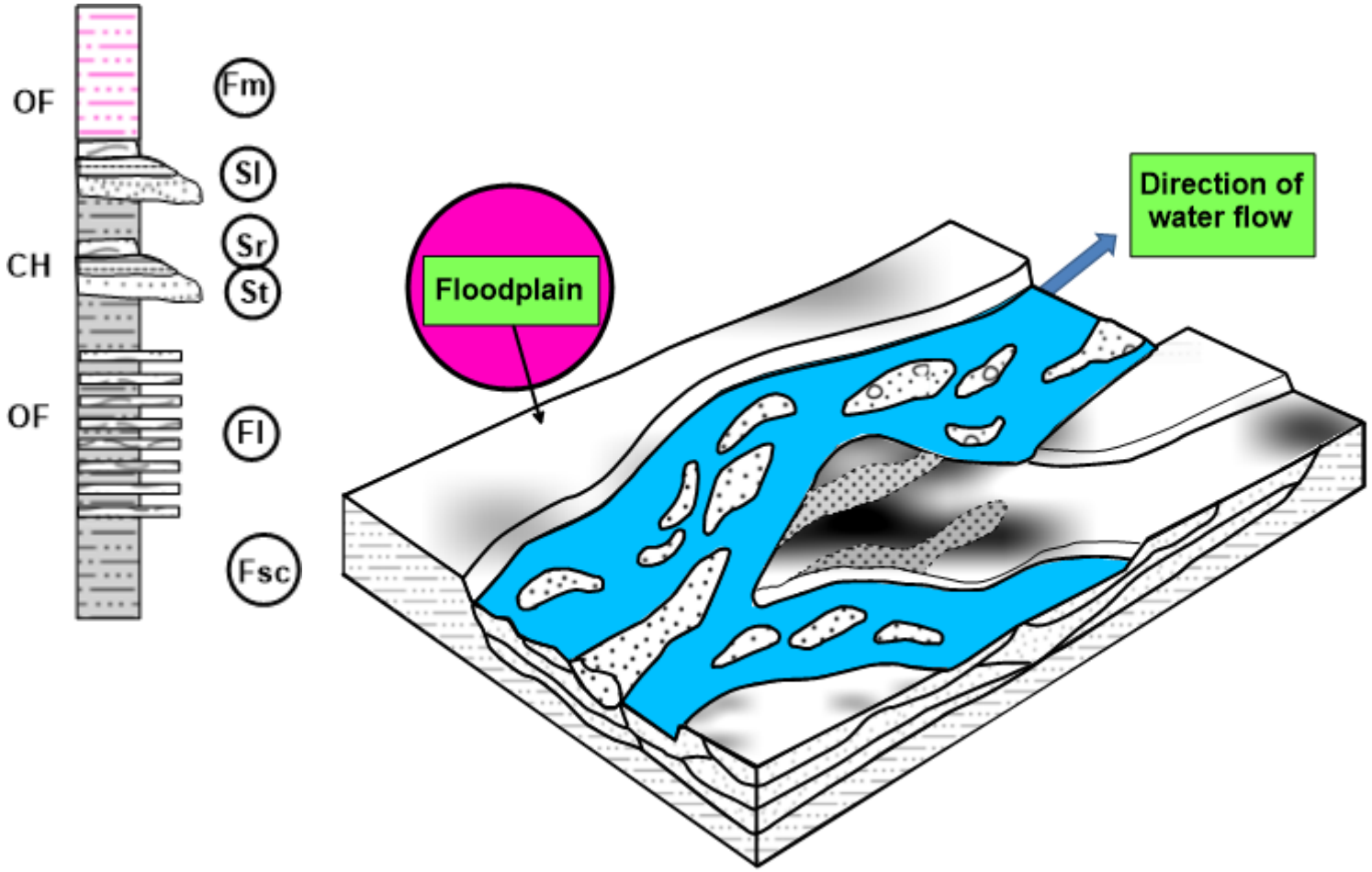
2. Sand bar facies association (SB)

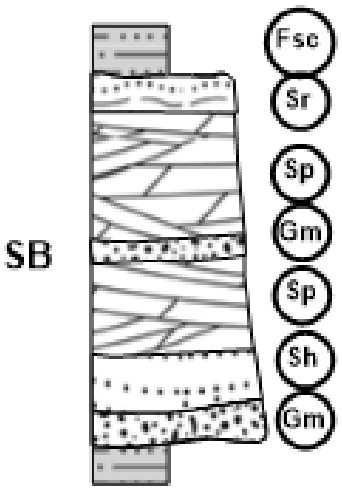


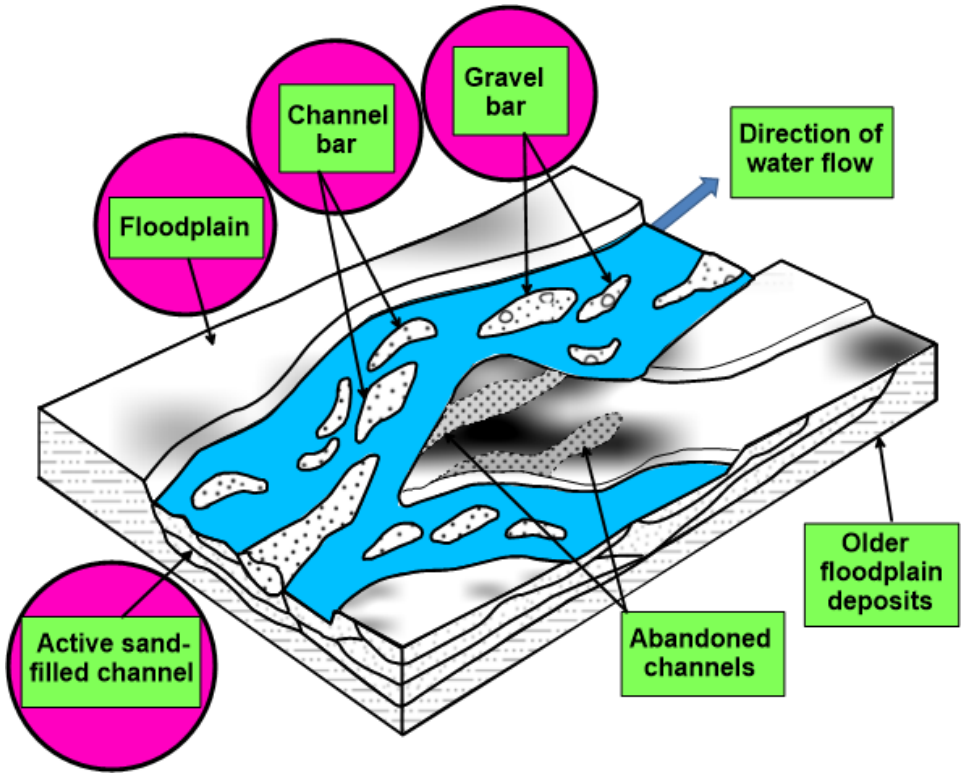
3. Gravel bar facies association (GB)

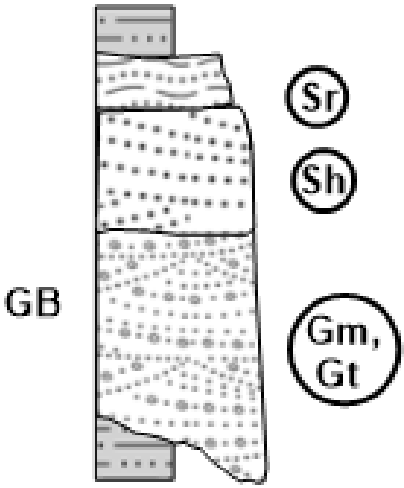


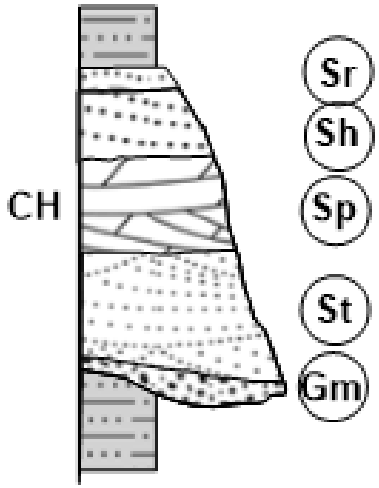
4. Overbank/flood fines facies association (OF)

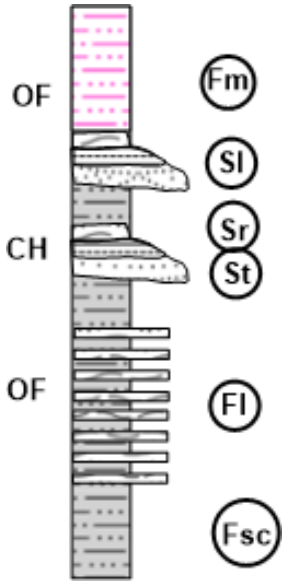



SB
Fsc
Sr
Sp
Gm
Sp
Sh
Gm


Floodplain
Channel bar
Gravel bar
Direction of water flow
Active sand-filled channel
Abandoned channels
Older floodplain deposits


GB
Sr
Sh
Gm, Gt

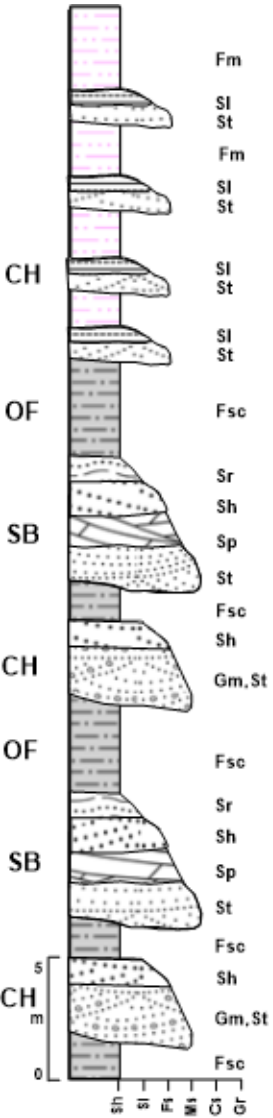

CH
Sr
Sh
Sp
St
Gm


OF
Fm
Sl
CH
Sr
St
OF
Fl
Fsc

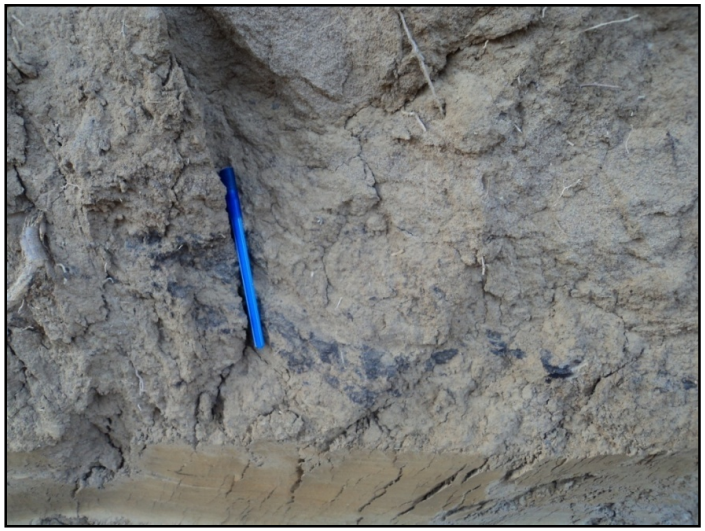
Lithofacies of Natma Formation (Middle Miocene)

1. Massive nodular clay with fine-grained sandstone facies (Fsc)
2. Medium to thick-bedded, coarse-grained to gritty trough–cross bedded sandstone (Gt) with basal erosional surface (Se) facies
3. Planar cross-stratified sandstone facies (Sp)
4. Thinly bedded siltstone or silty fine sandstone and shale facies (Fl)
5. Massive, variegated silty clay facies (Fm)

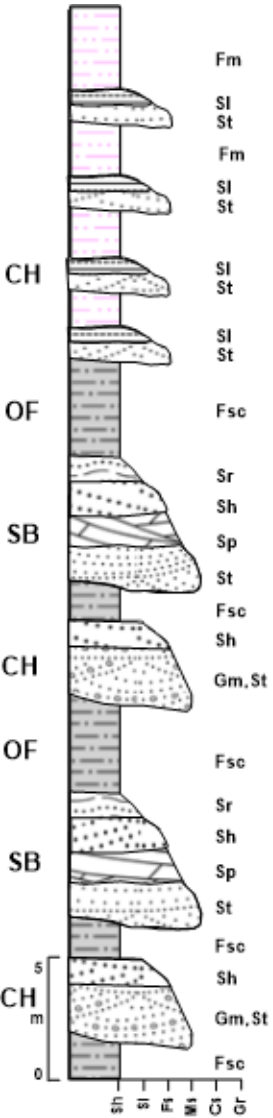
1. **Massive silty nodular clay intercalated with fine-grained sandstone facies (Fsc)**



Overbank/floodfines of fluvial channel

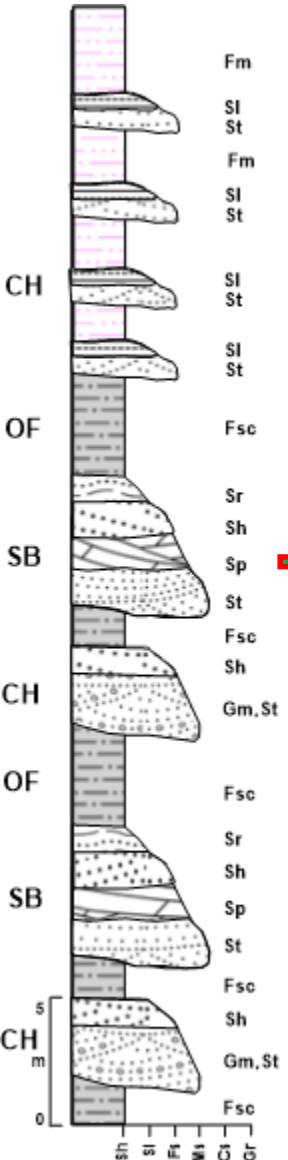


2. Medium to thick-bedded, coarse-grained to gritty trough cross-bedded sandstone (Gt) with basal erosional surface (Se) facies

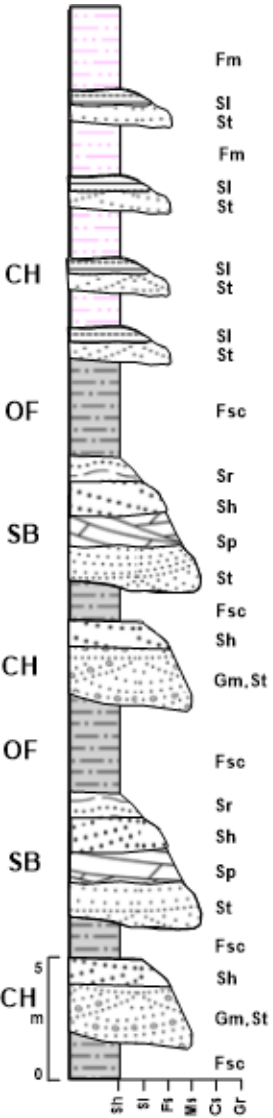


Channel lag deposit of the braided river

3. Planar cross-stratified sandstone Facies (Sp)

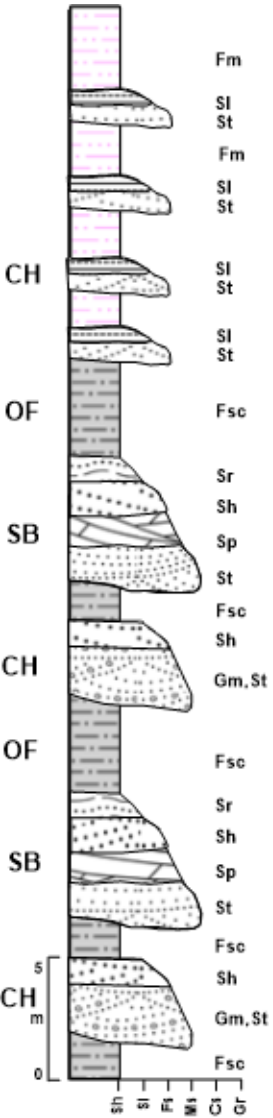


4. Thinly bedded siltstone or silty fine sandstone and shale facies (Fl)



Subaqueous levee deposits

5. Massive, variegated silty clay facies (Fm)

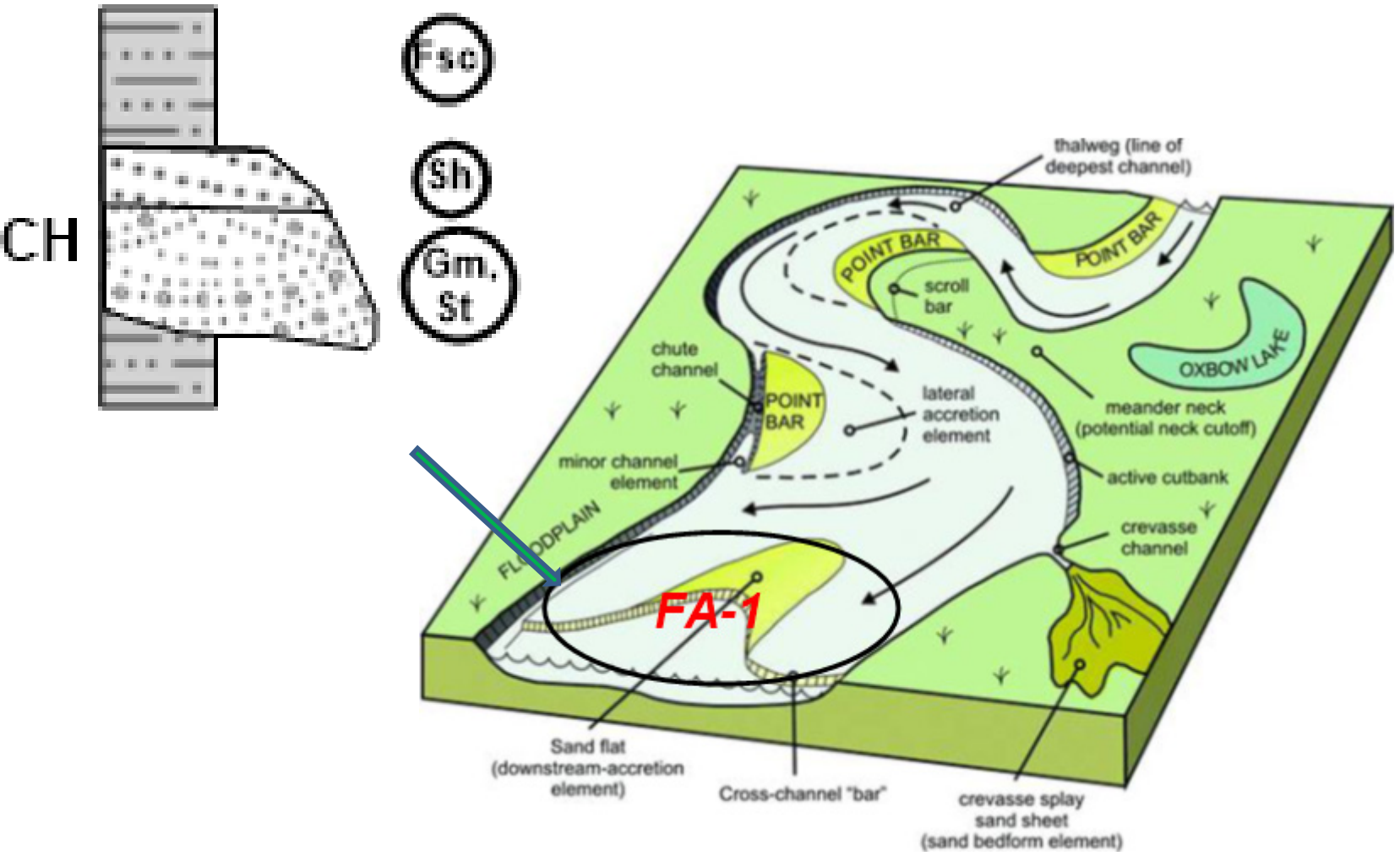


Backswamp

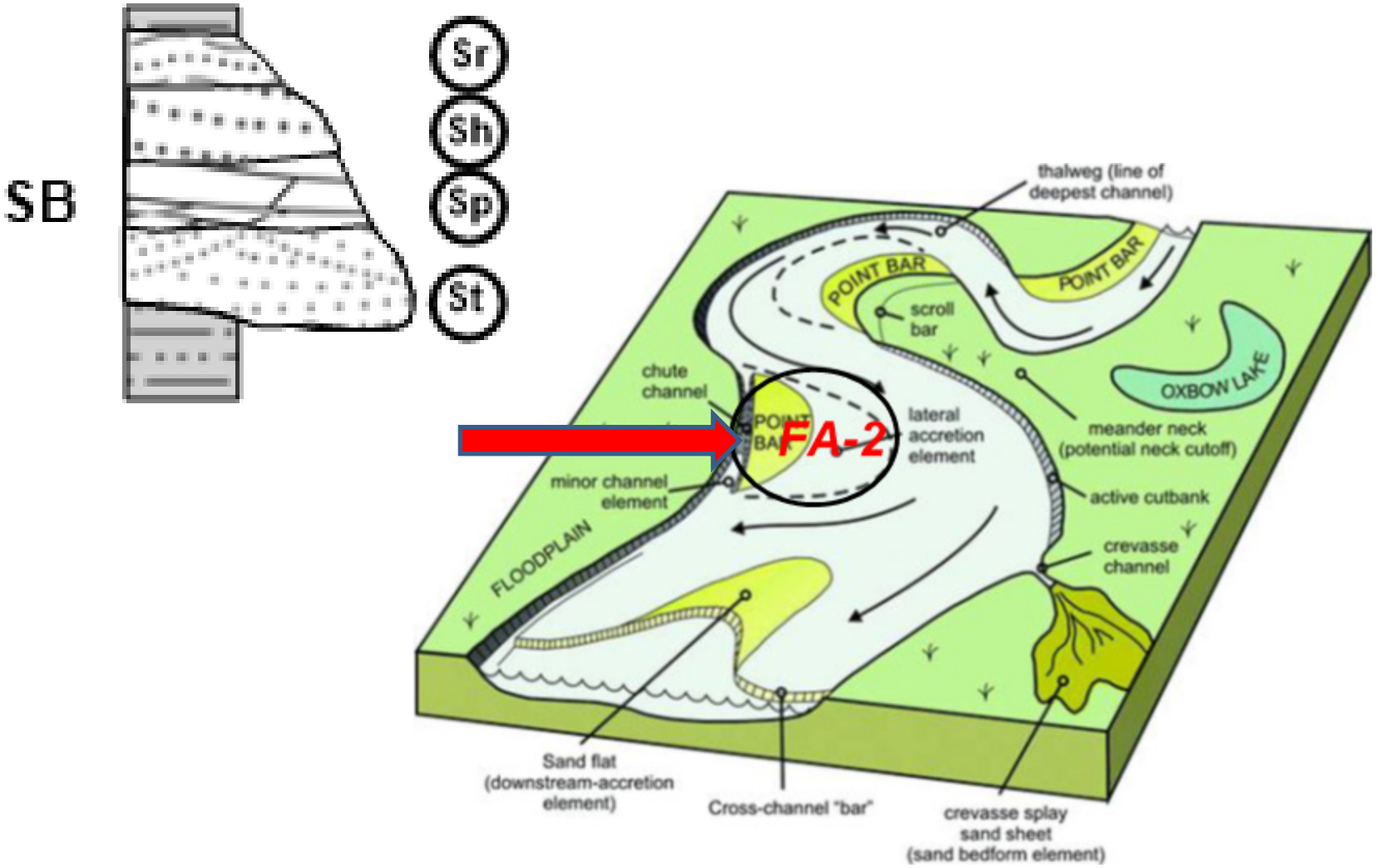
Lithofacies Association of Natma Formation

1. Sandy fluvial channel facies association (Ch)
2. Sand bar facies association (Sb)
3. Overbank/flood fines facies association (OF)

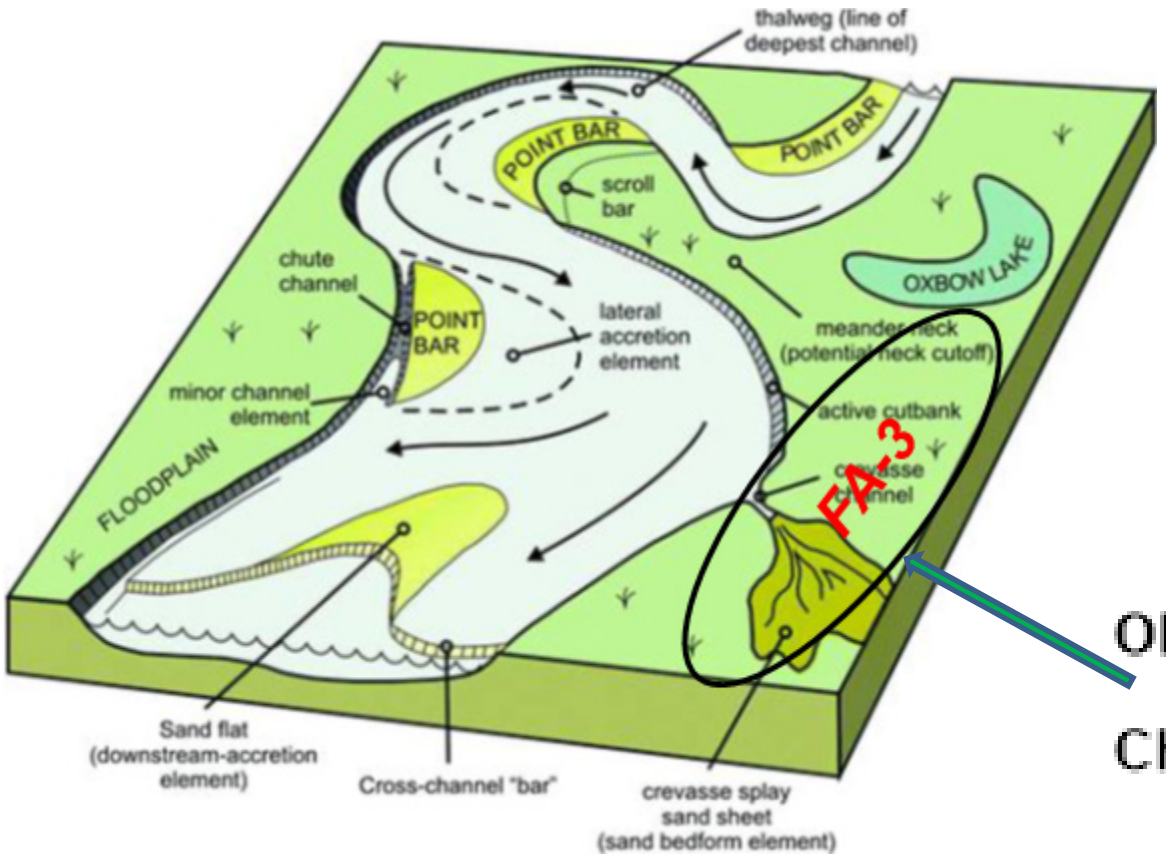
1. Sandy fluvial channel facies association (CH)

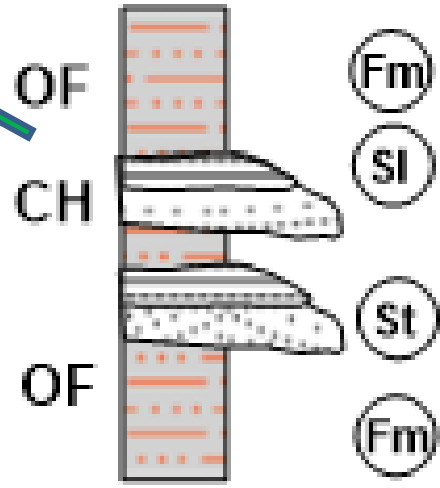


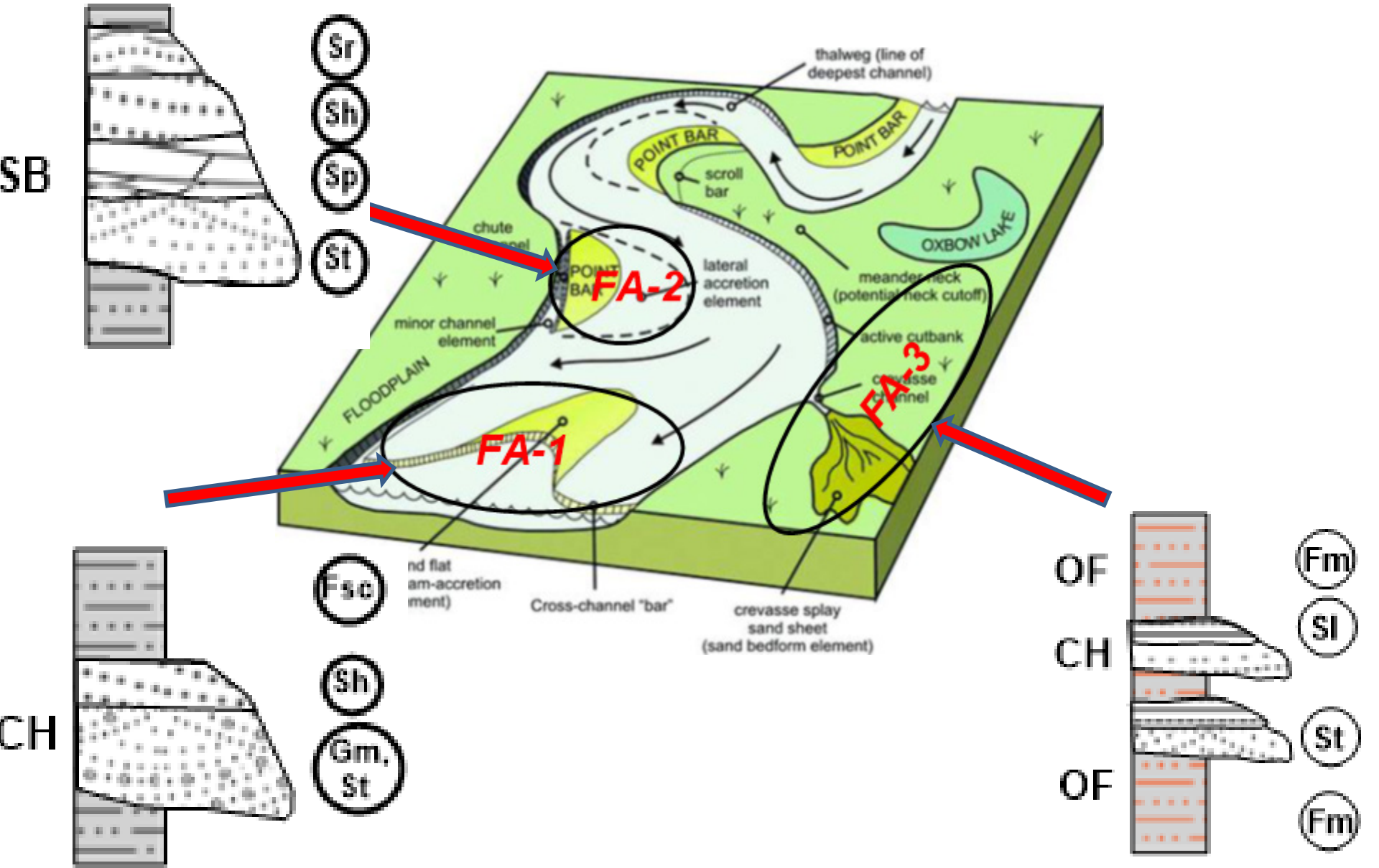
2. Sandy bar facies association (SB)



3. Overbank/ flood fines facies association (OH)



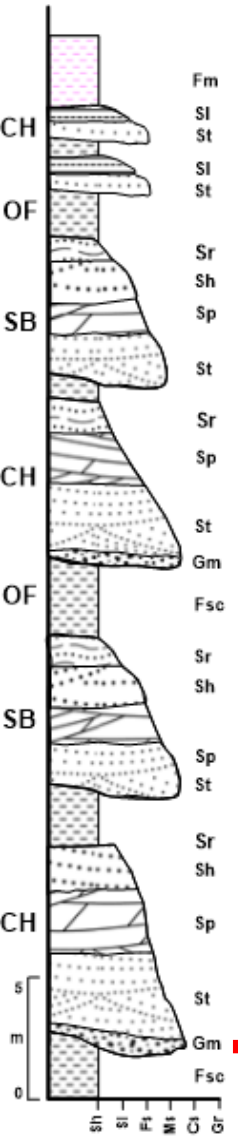



SB
Sr
Sh
Sp
St
thalweg (line of deepest channel)
POINT BAR
POINT BAR
scroll bar
OXBOW LAKE
chute
POINT BAR
FA-2
lateral accretion element
meander neck (potential neck cutoff)
minor channel element
active cutbank
FLOODPLAIN
FA-3
FA-1
Fsc
nd flat
am-accretion
ment)
Cross-channel "bar"
crevasse splay sand sheet (sand bedform element)
CH
Sh
Gm, St
OF
Fm
CH
Sl
St
OF
Fm

Lithofacies Shwethamin Formation (Late Miocene)

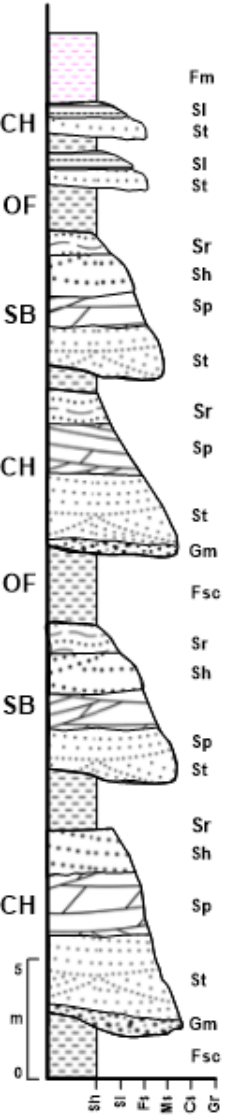
1. Gritty to pebbly sandstone facies (Gm)
2. Trough cross-bedded sandstone facies (St)
3. Planar cross-bedded sandstone facies (Sp)
4. Horizontal laminated sandstone facies (Sh)
5. Thinly laminated fine sandstone and siltstone facies (Fl)
6. Massive, variegated silty clay facies(Fm) \

1. Conglomeratic gritty sandstone facies (Gm)



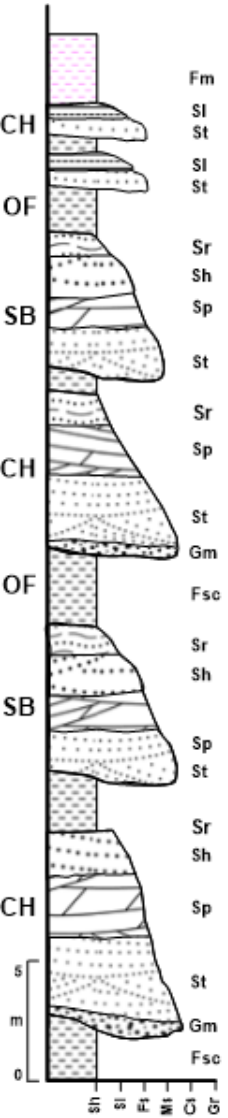
Channel lag deposit of meandering river

2. Trough cross-stratified sandstone facies (St) with basal erosional surface (Se) facies



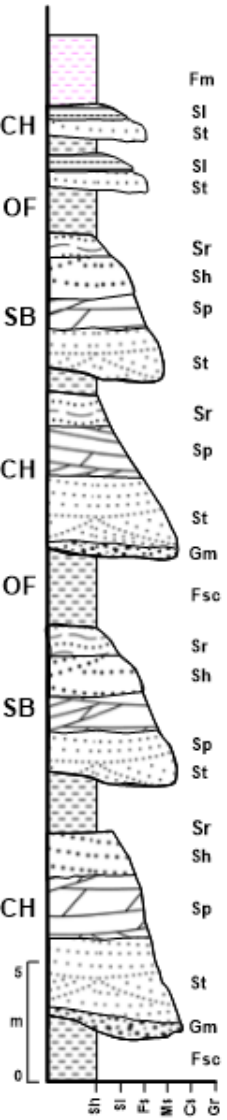
Basal portion of a sandy fluvial meandering channel

3. Planar cross-stratified sandstone facies (St)



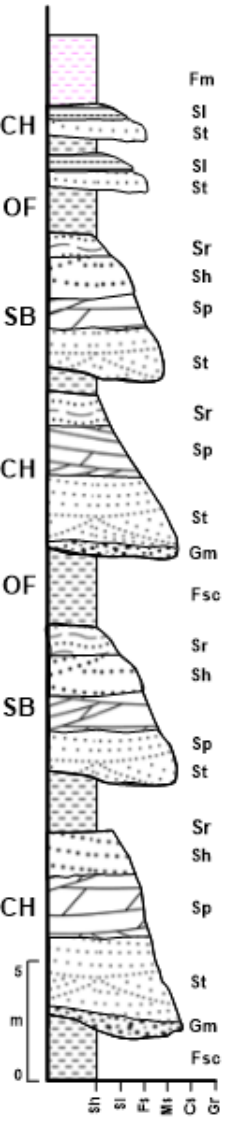
Transverse bars or dunes of active fluvial channel

4. Horizontal laminated sandstone facies (Sh)



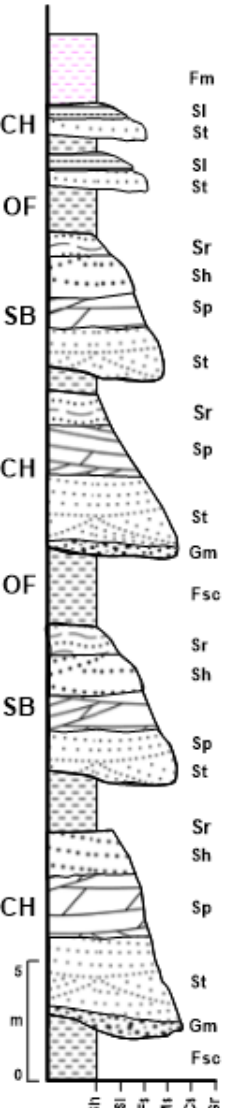
Shallow, high-energy (upper flow regime) conditions of fluvial channel

5. Thinly laminated fine sandstone facies (Sl)



Crevasse splay of meandering river

6. Variegated silty shale with silt and sand bands facies (Fm)

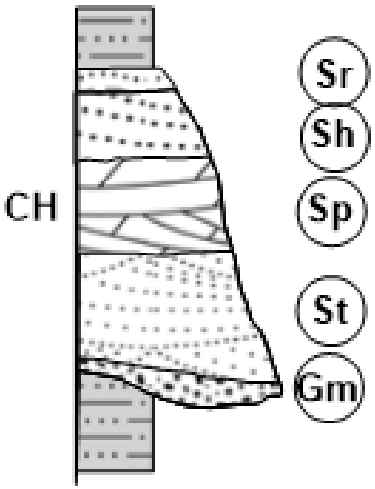


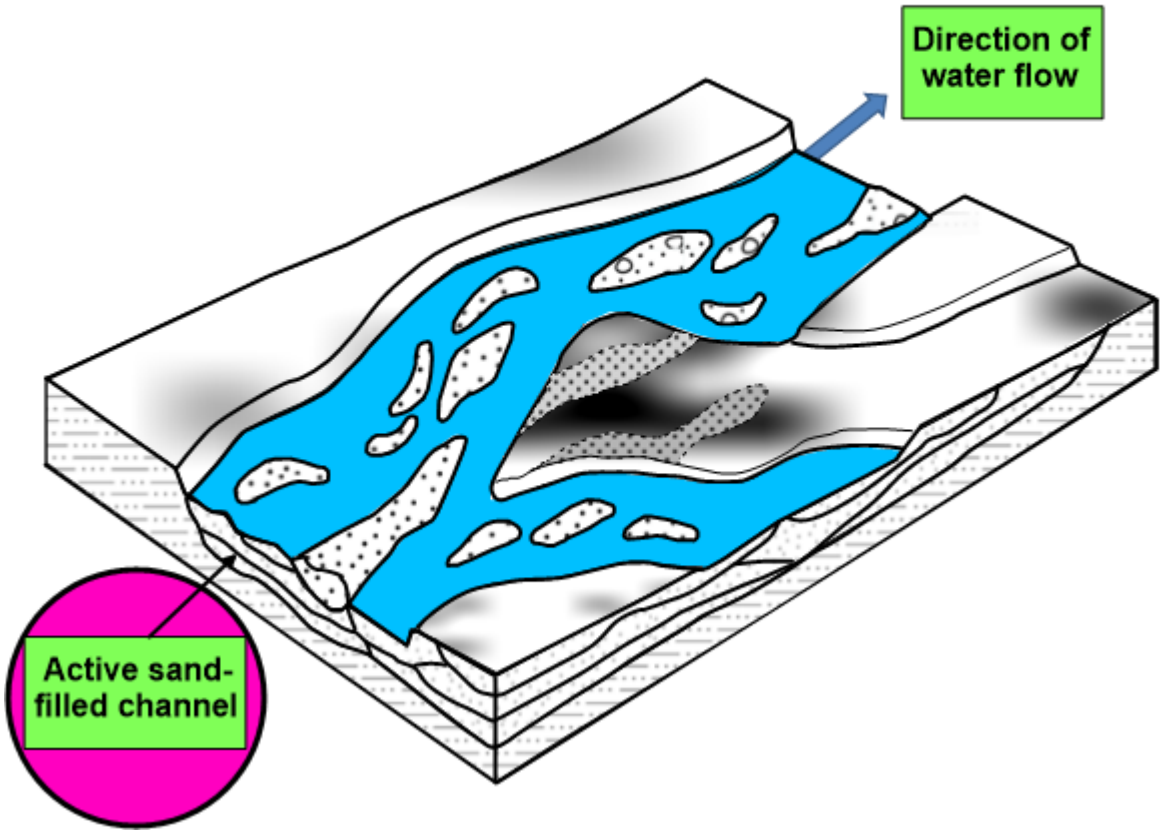
Backswamp deposit of meandering river

Lithofacies Association of Shwethamin Formation

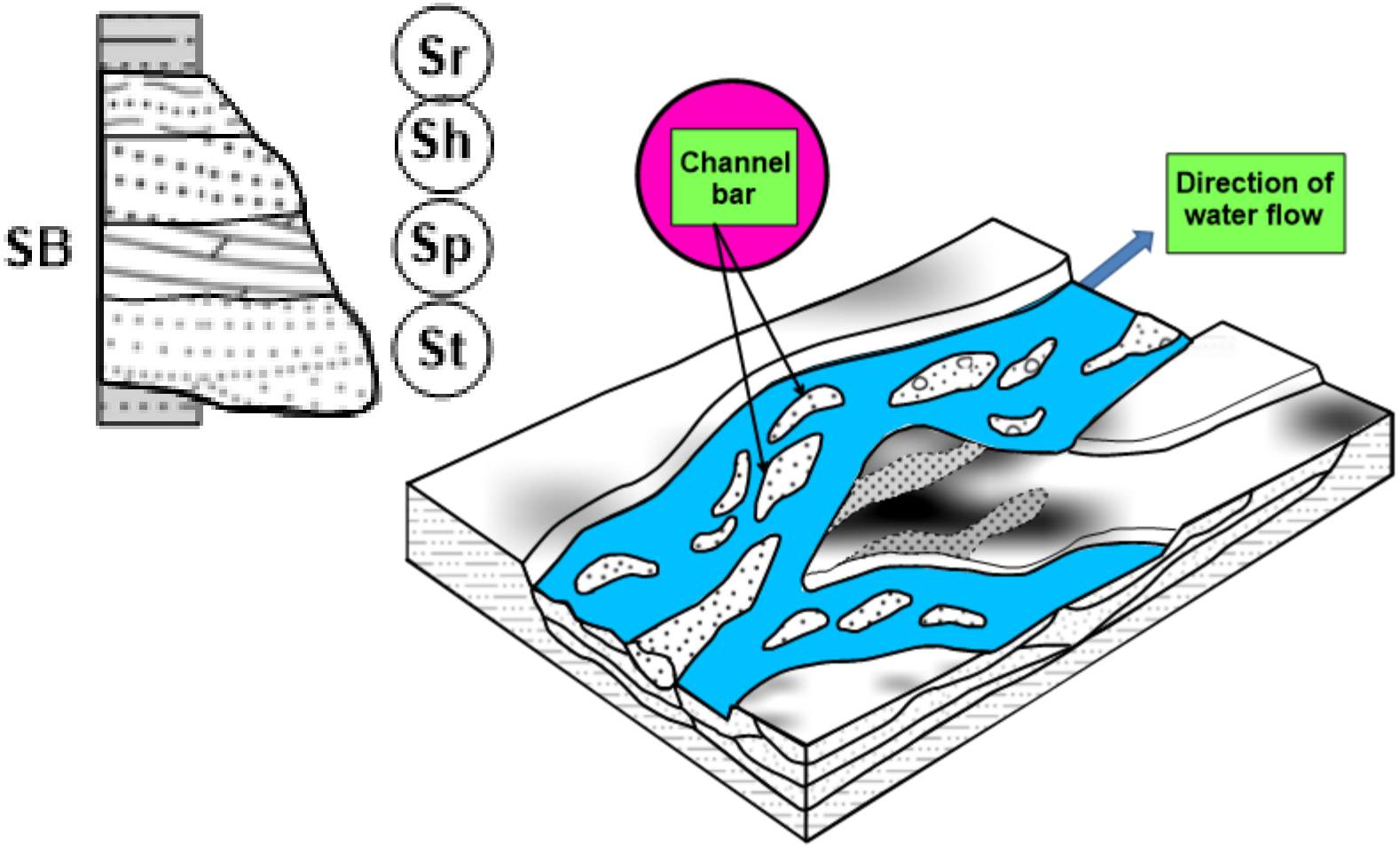
1. Sandy fluvial channel facies association (Ch)
2. Sand bar facies association (Sb)
3. Gravel bar facies association (Gb)
4. Overbank/flood fines facies association (OF)

1. Sandy fluvial channel facies association (Ch)

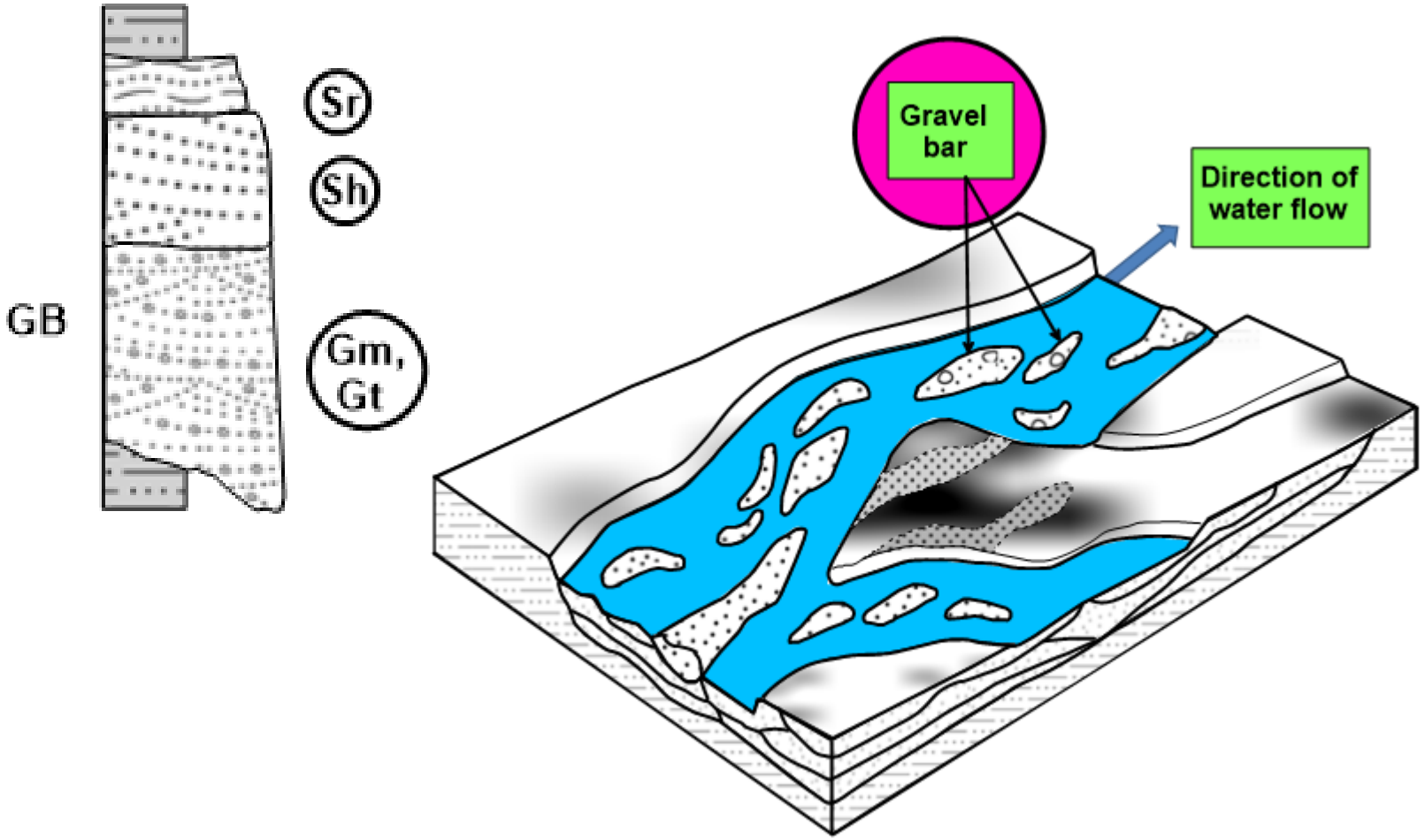




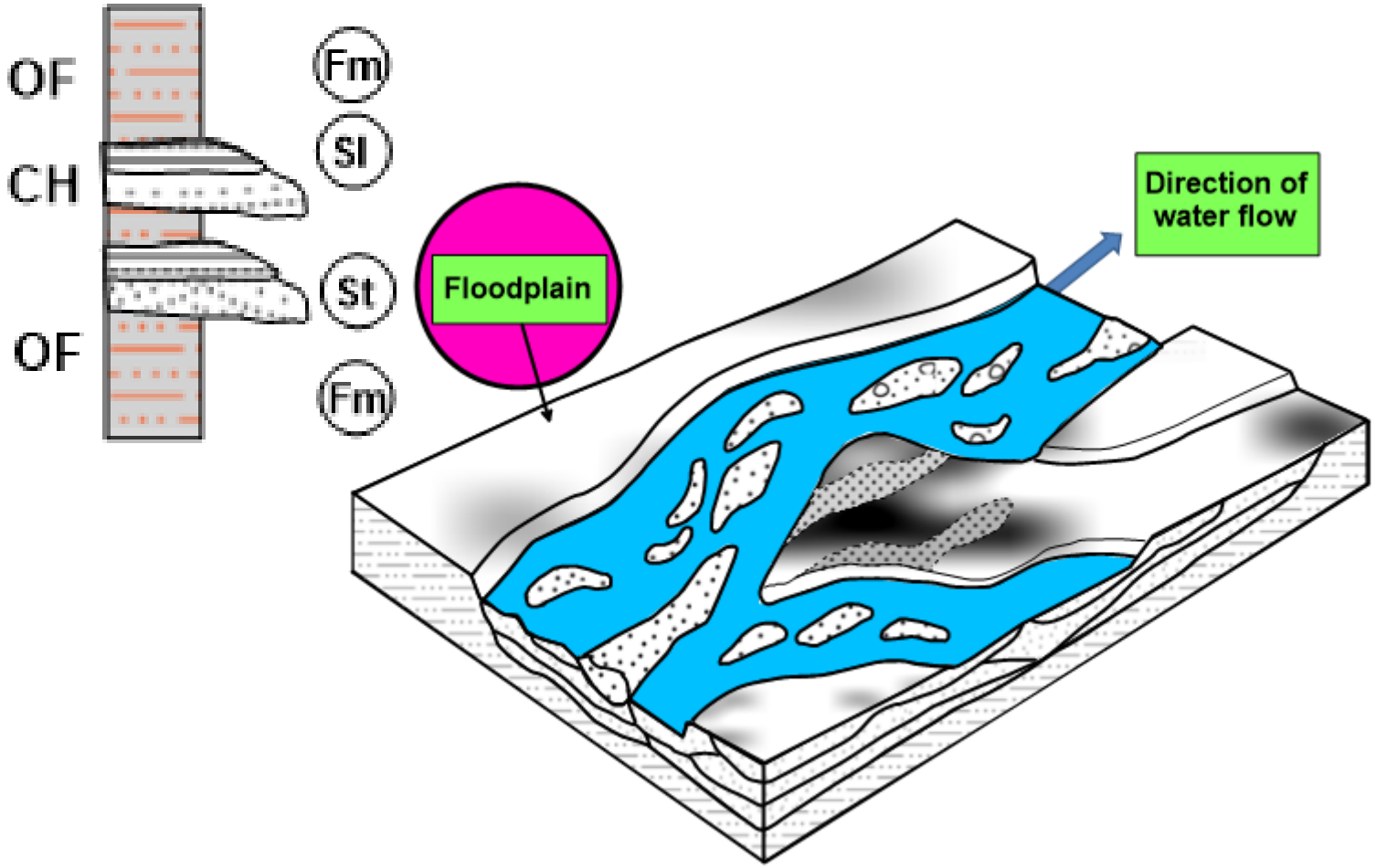
2. Sand bar facies association (SB)

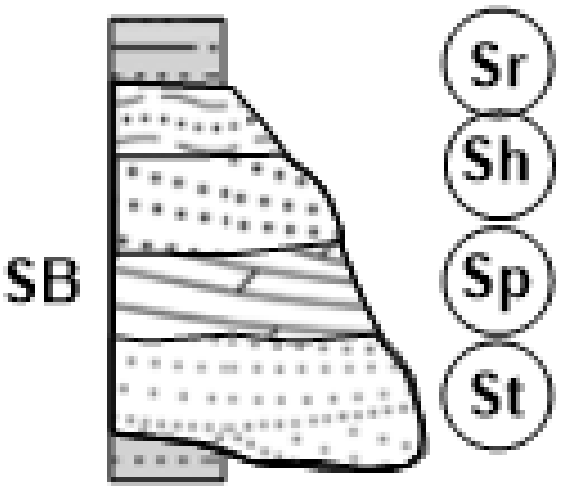


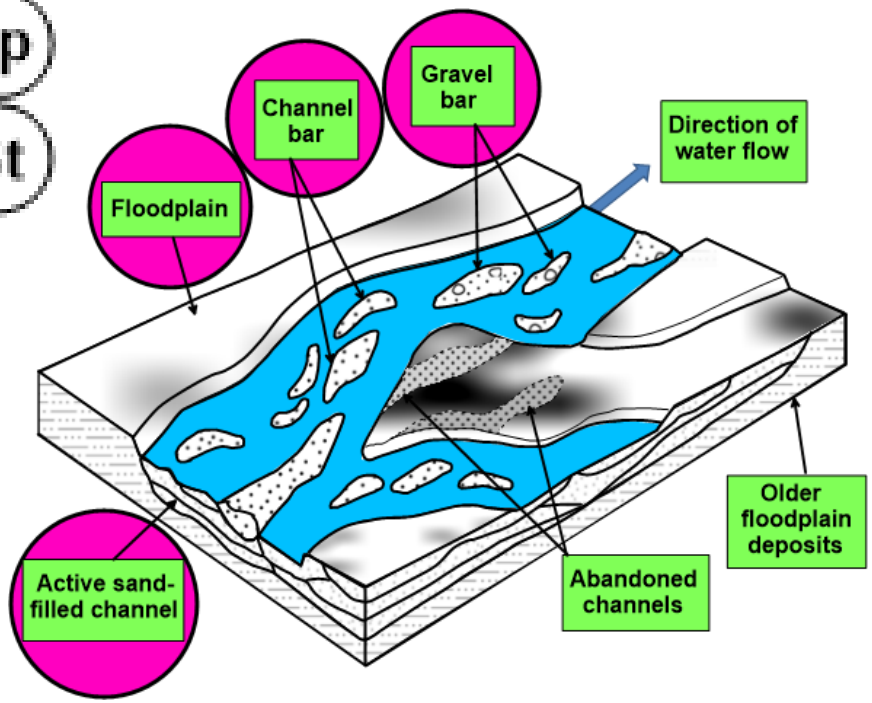
3. Gravel bar facies association (GB)

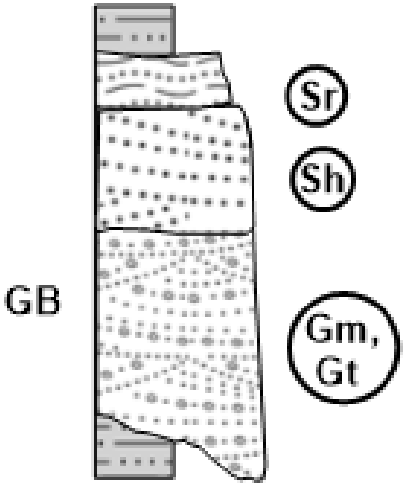


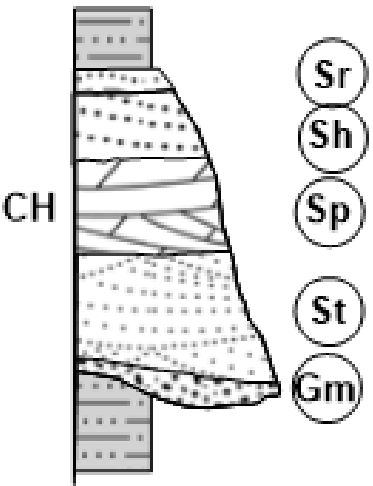
4. Overbank/flood fines facies association (OF)

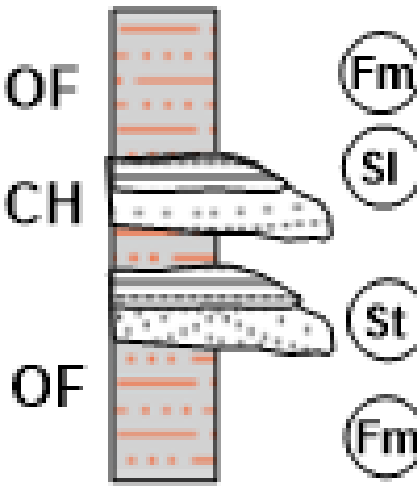



SB
Sr
Sh
Sp
St

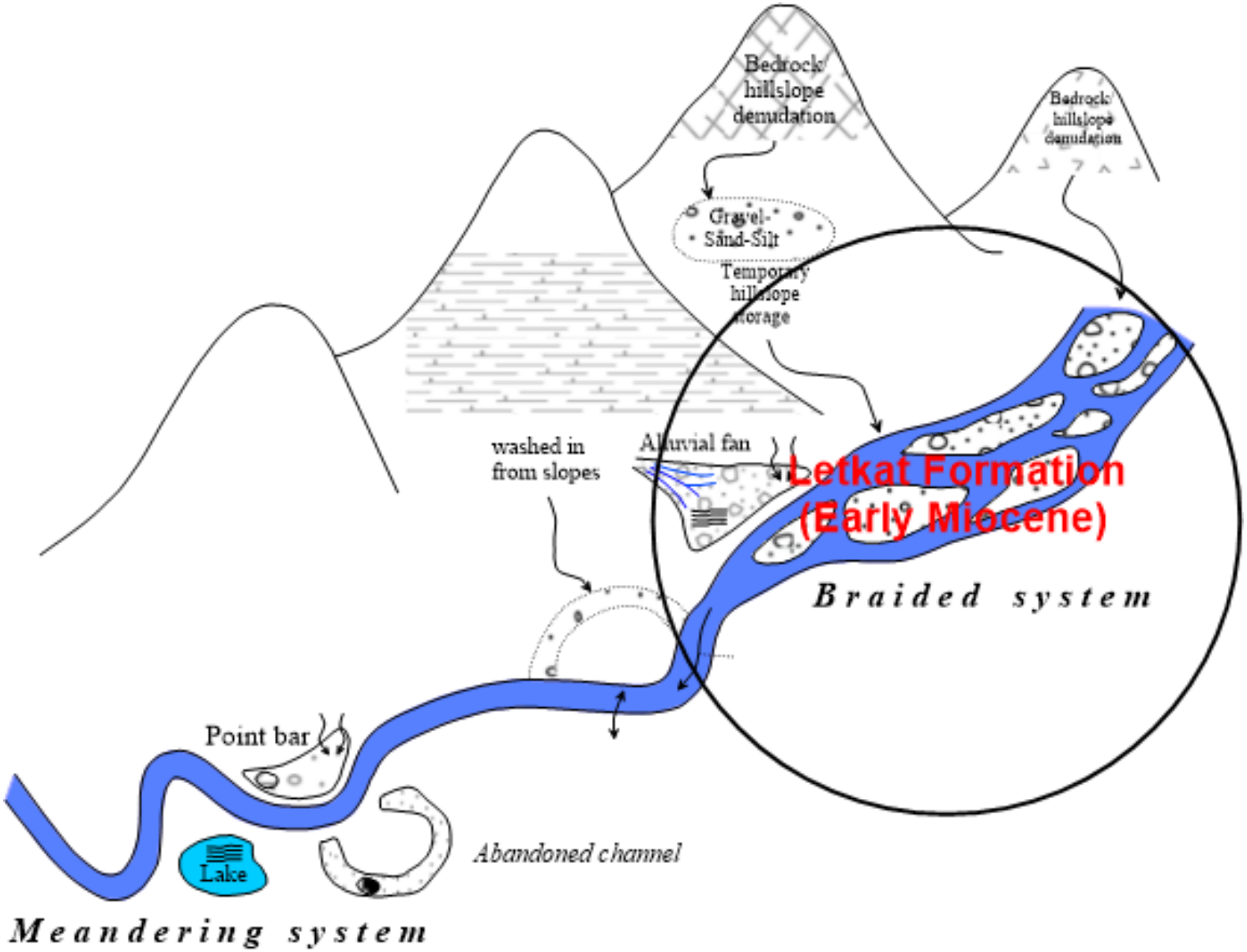

Floodplain
Channel bar
Gravel bar
Direction of water flow
Active sand-filled channel
Abandoned channels
Older floodplain deposits

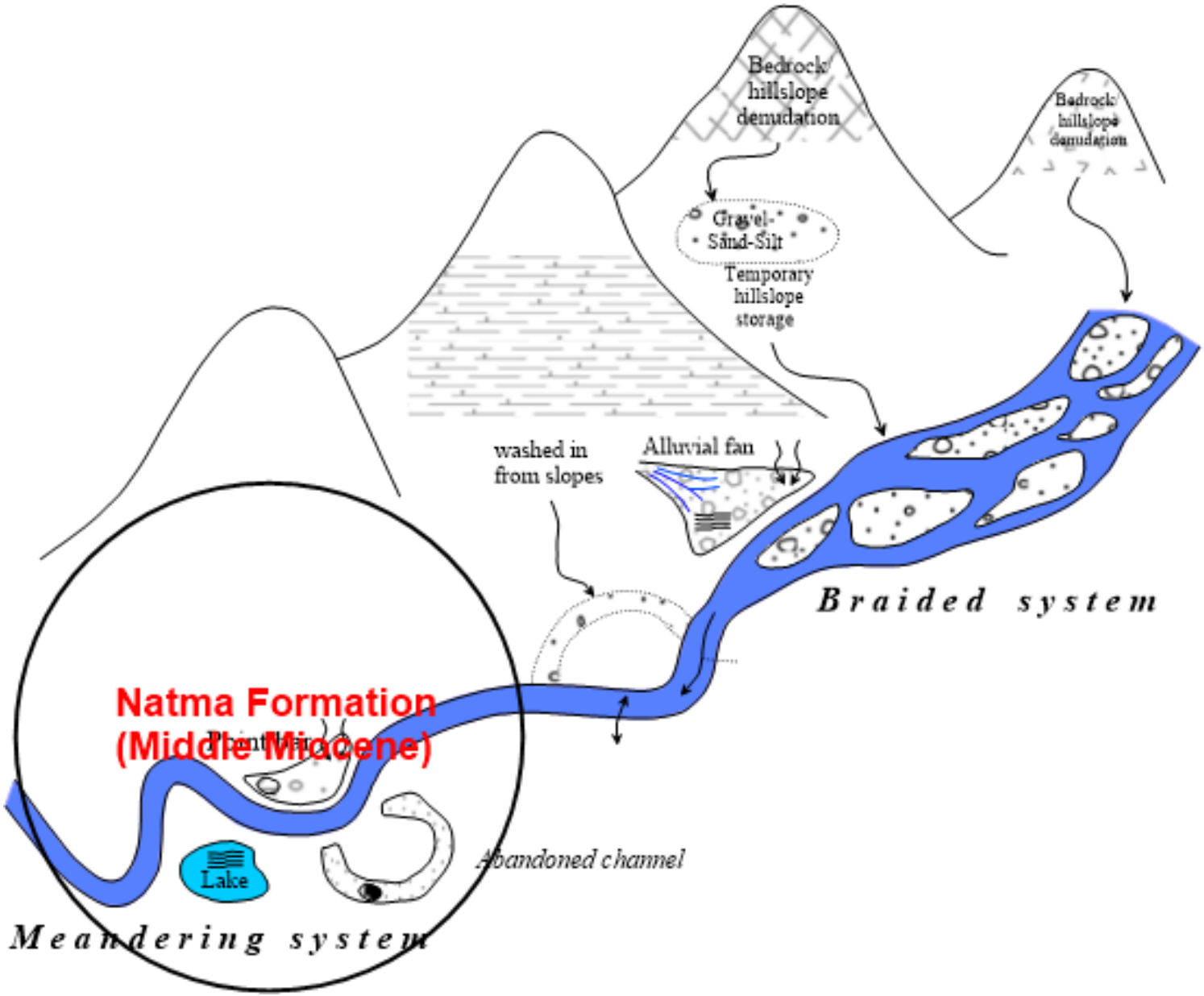

GB
Sr
Sh
Gm, Gt

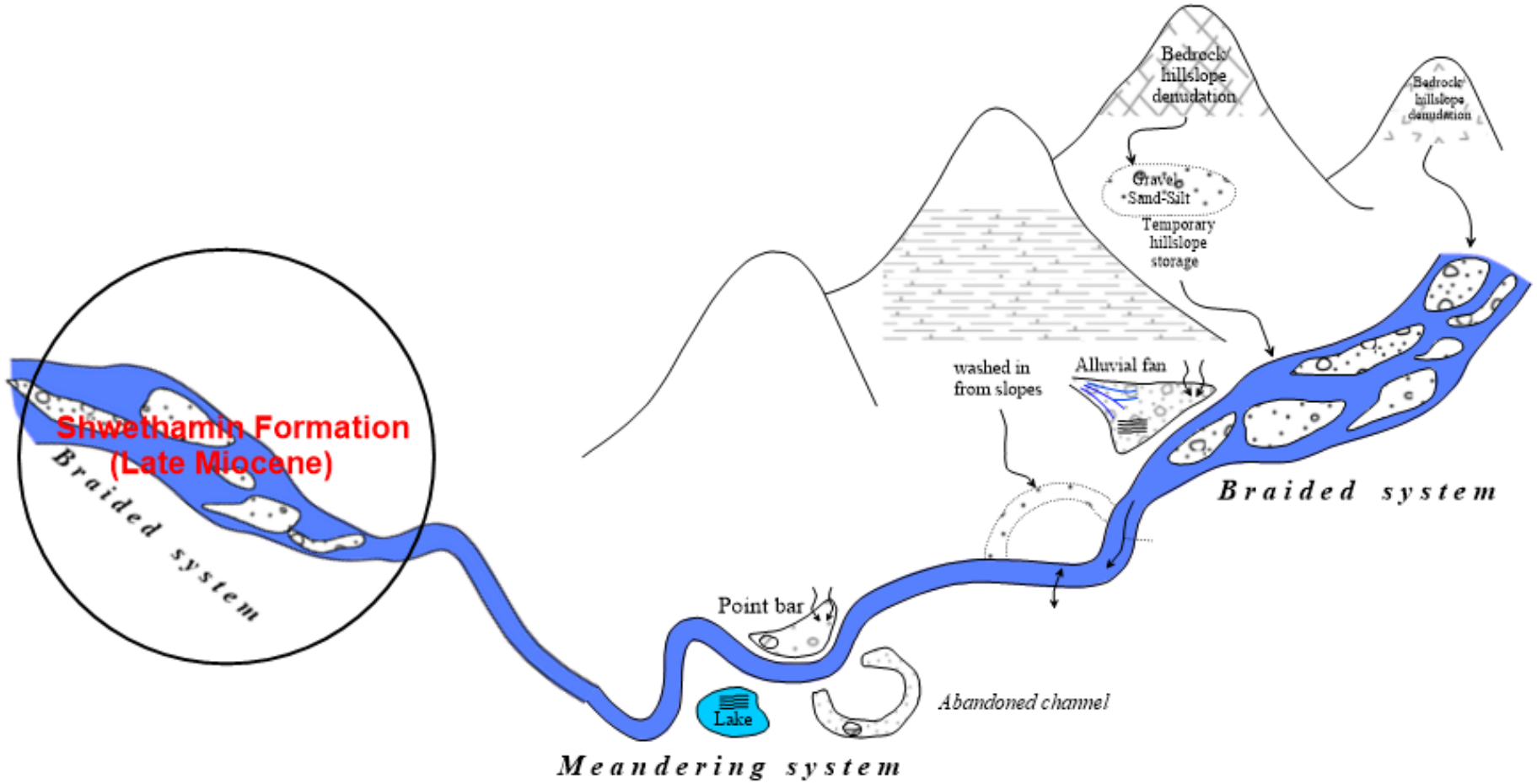

CH
Sr
Sh
Sp
St
Gm

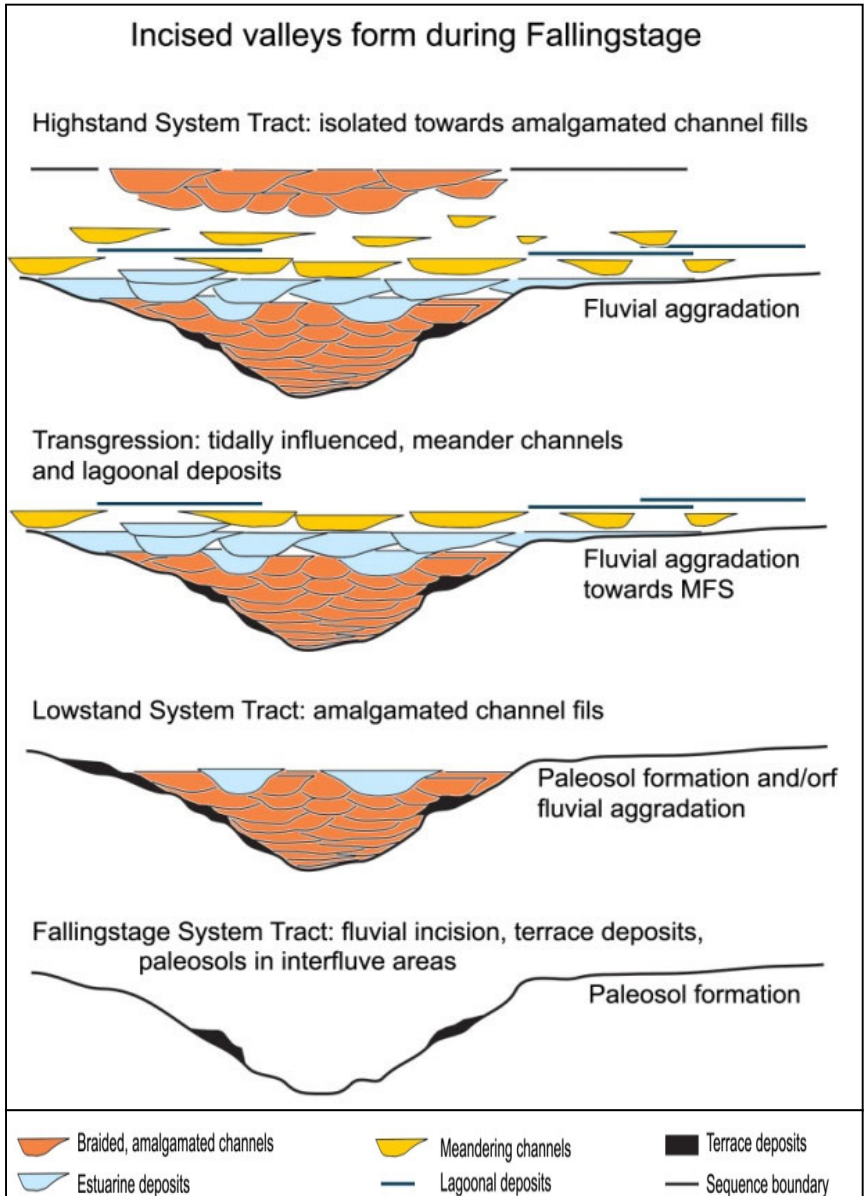

OF
CH
OF
Fm
Sl
St
Fm

IV. Conclusion

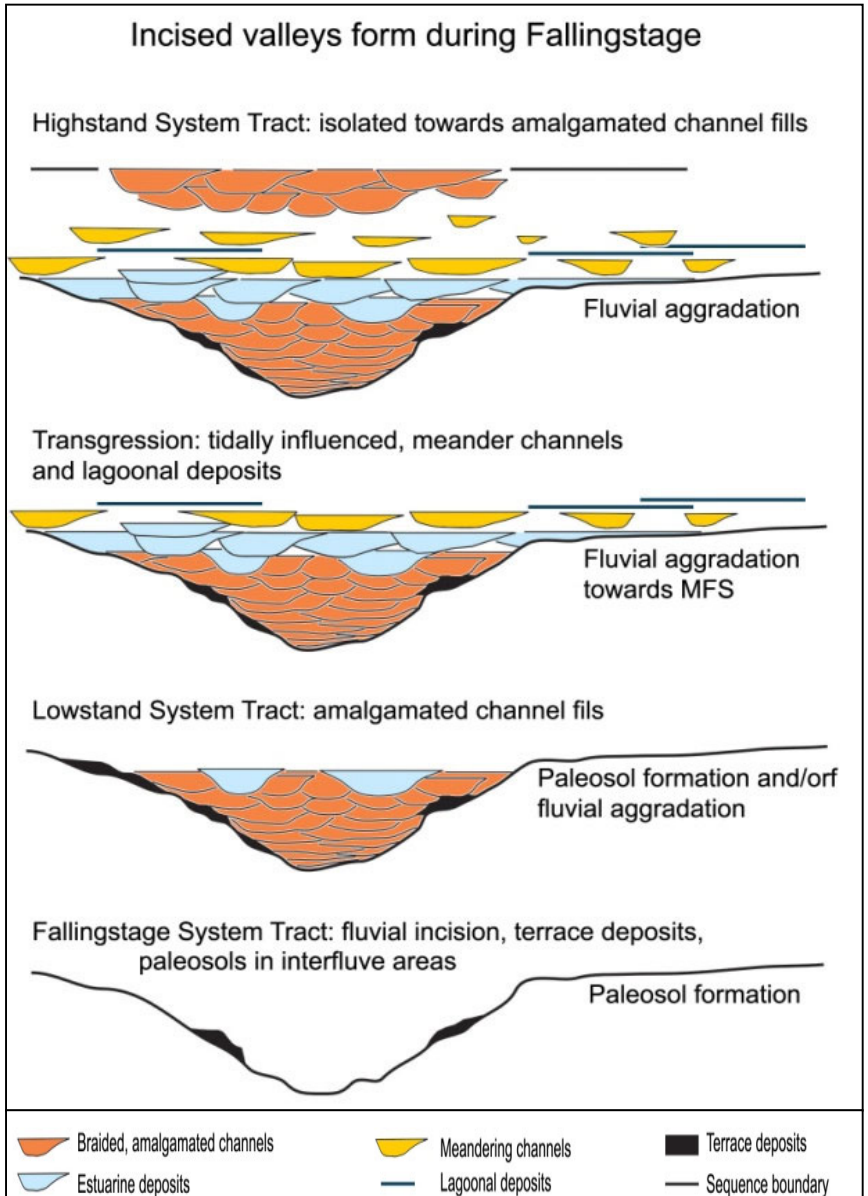

Bedrock hillslope denudation
Bedrock hillslope denudation
Gravel-Sand-Silt
Temporary hillslope storage
washed in from slopes
Alluvial fan
Letkat Formation (Early Miocene)
Braided system
Point bar
Abandoned channel
Lake
Meandering system


Bedrock hillslope denudation
Bedrock hillslope denudation
Gravel-
Sand-Silt
Temporary hillslope storage
washed in from slopes
Alluvial fan
Braided system
Natma Formation
(Middle Miocene)
Point bar
Lake
Abandoned channel
Meandering system

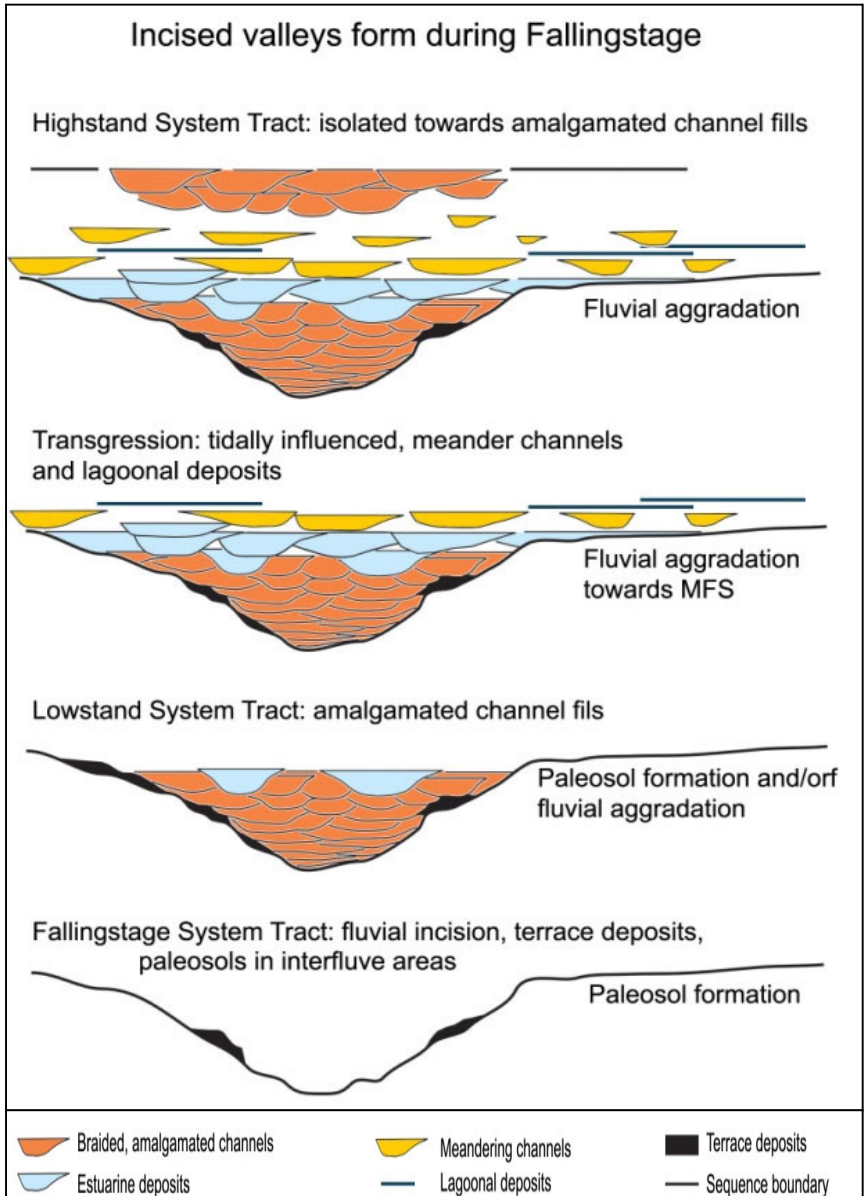

Shwethamin Formation
(Late Miocene)
Braided system
Bedrock hillslope denudation
Bedrock hillslope denudation
Gravel
Sand-Silt
Temporary hillslope storage
washed in from slopes
Alluvial fan
Braided system
Point bar
Lake
Abandoned channel
Meandering system



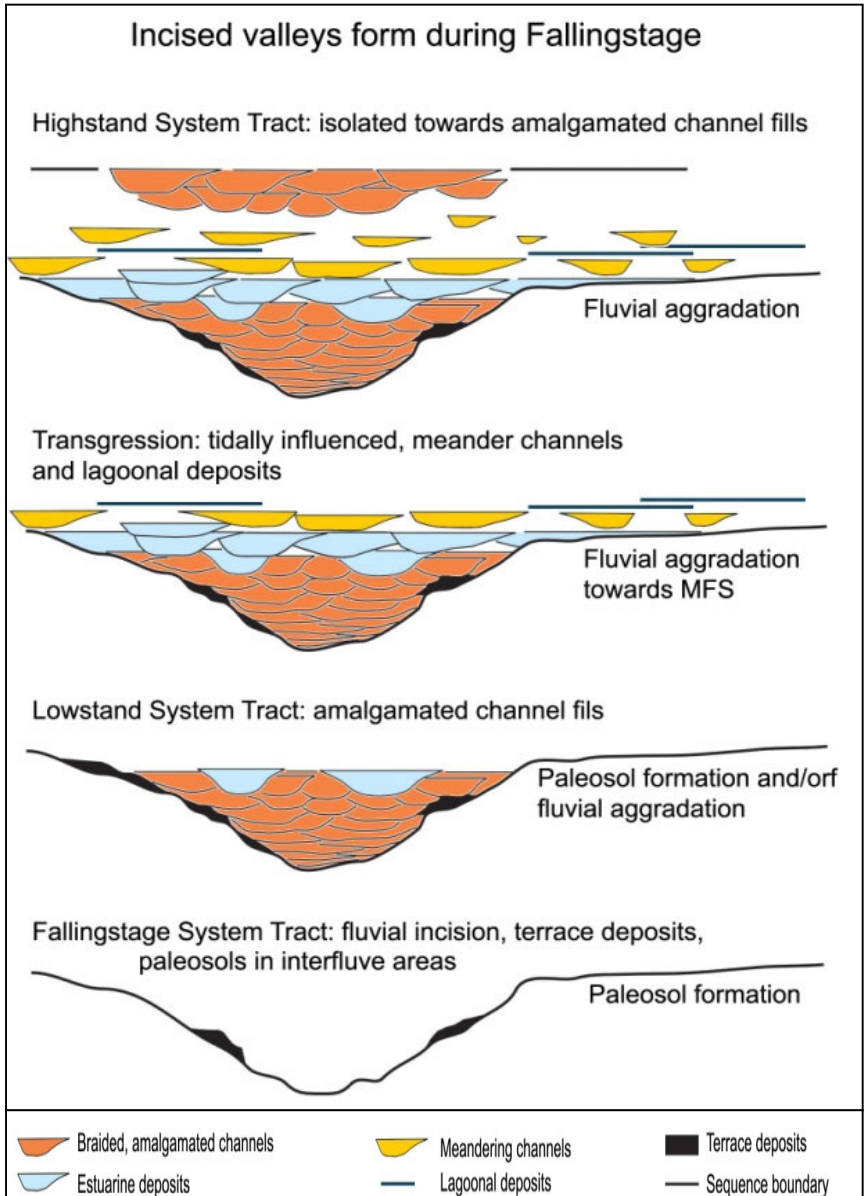
During Early Miocene, Letkat Formation was deposited in a fluvial-river system of the lowstand systems tract deposits (LST) deeply incised into the underlying Yaw Formation during relative sea-level fall, also be regarded as an incised fluvial channel-fill (IVF).



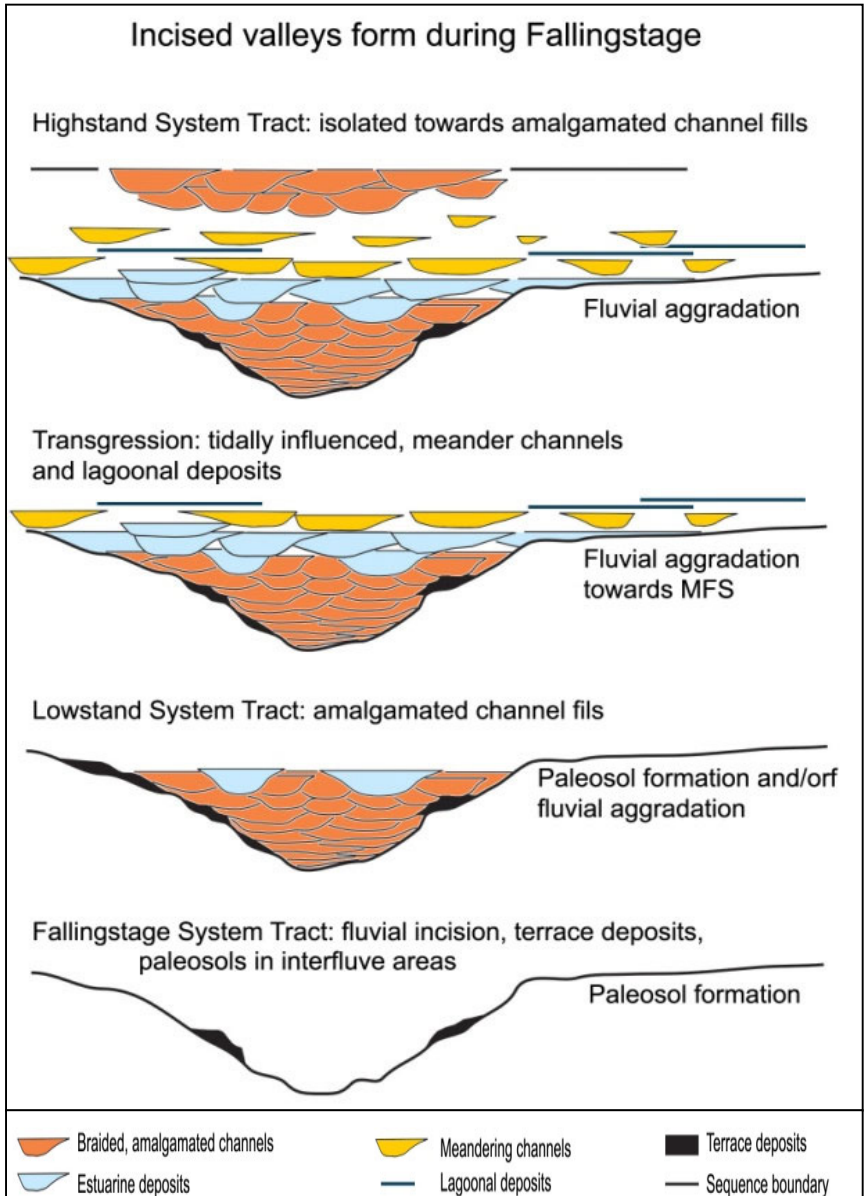
The fluvial sequence of the lower part Letkat Formation is characterized by high bed-load gravelly and sandy,



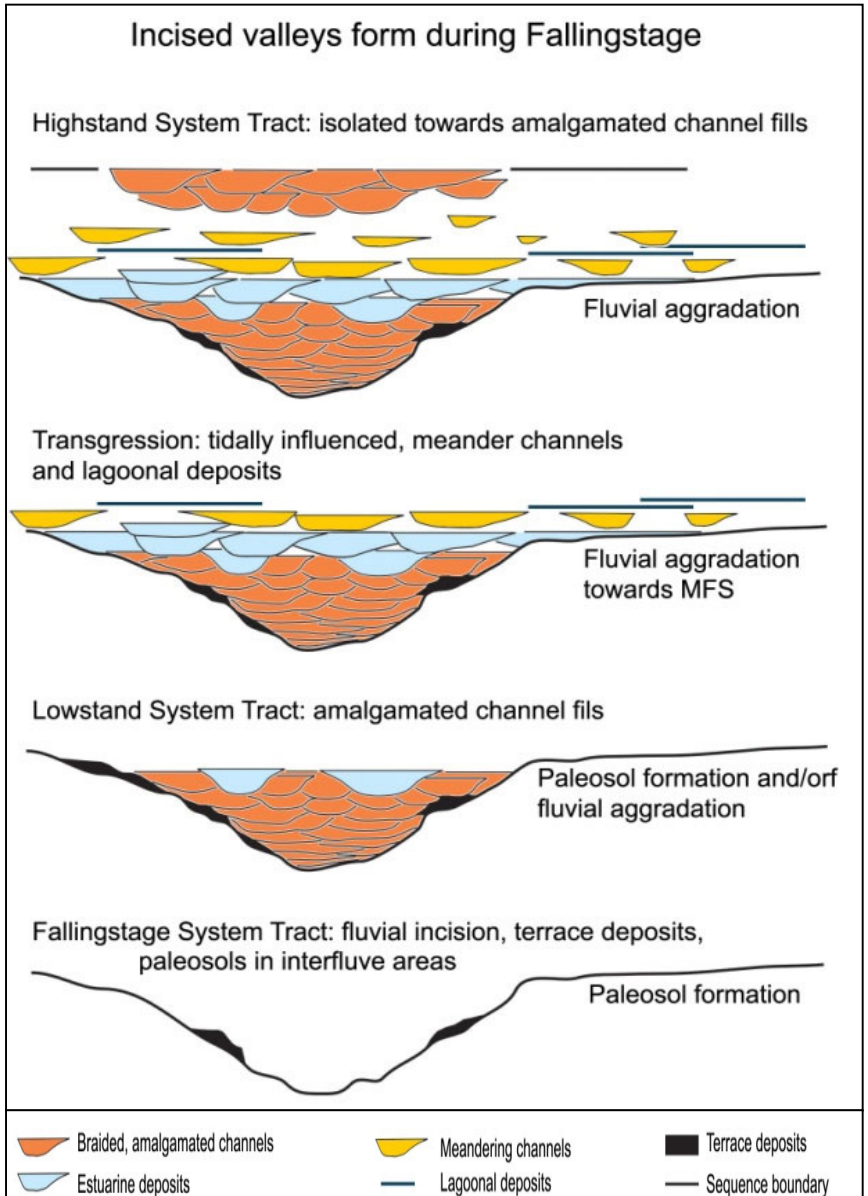
multi-story sand bodies of braided channel-complexes with general lack of the overbank fines

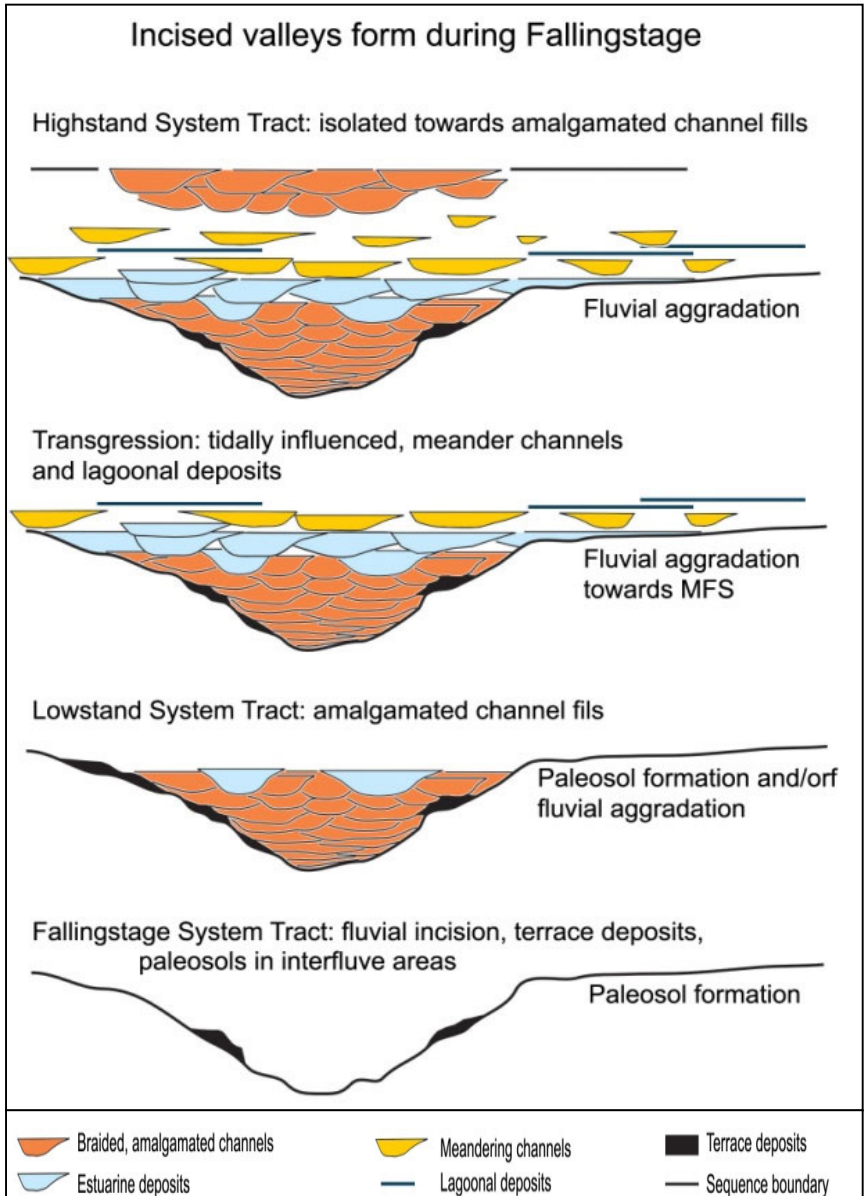


The middle part of the formation is constructed with the shallow and broad amalgamated sandy channels

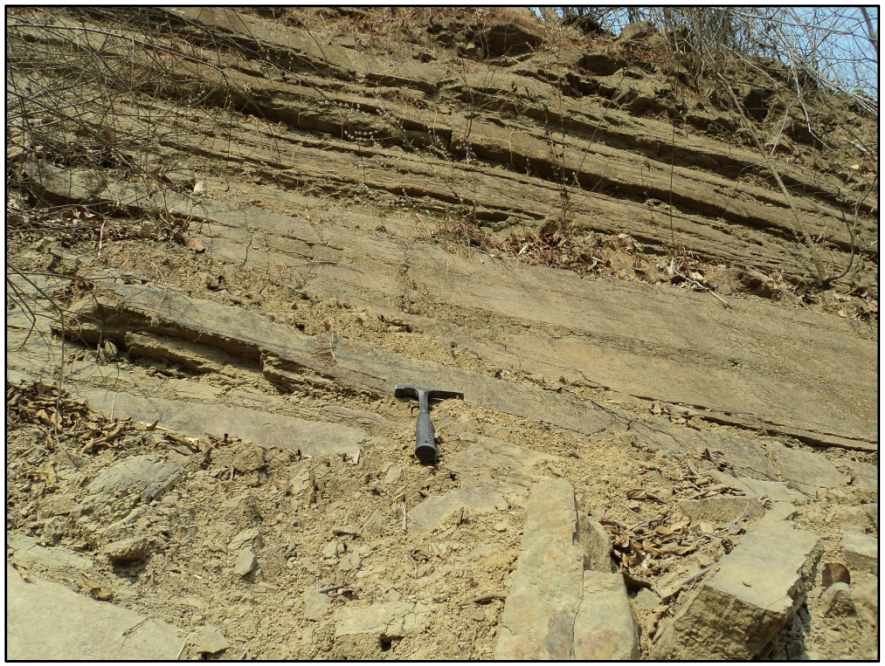


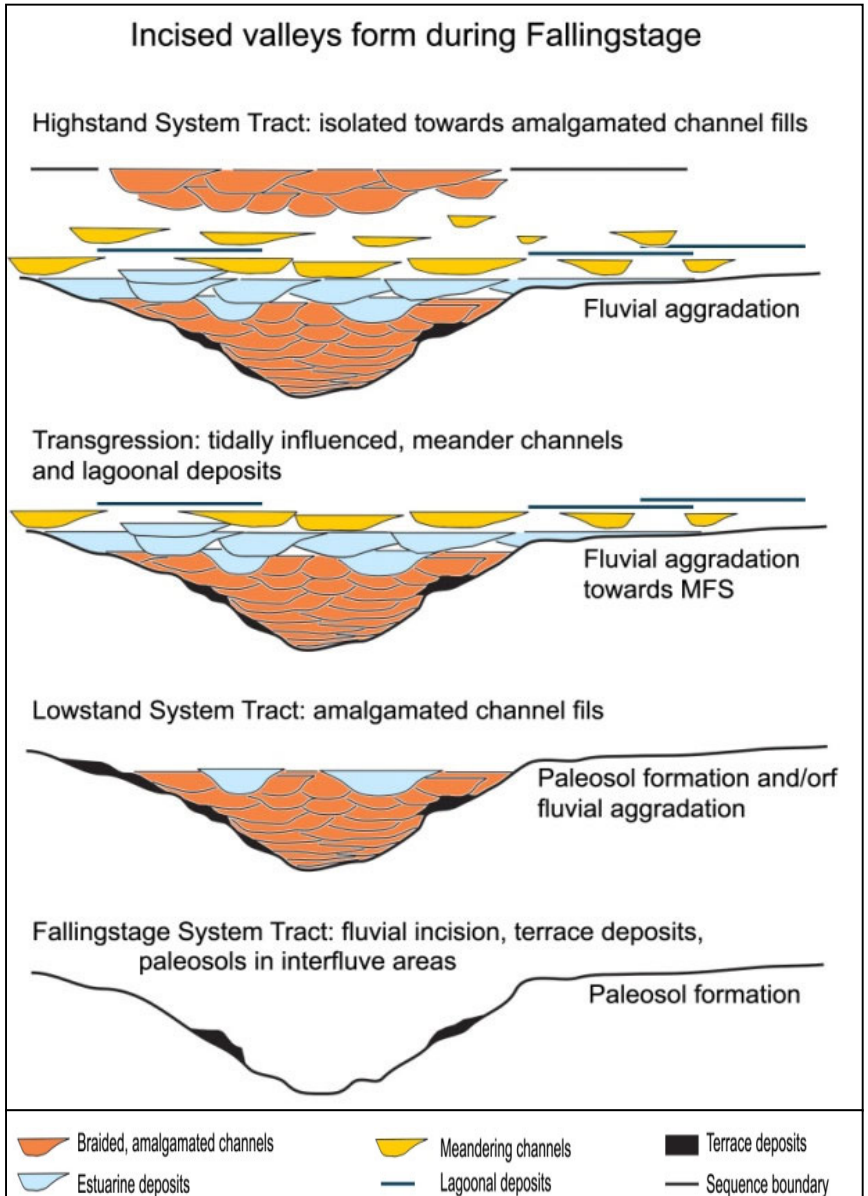
with thick laminated sheets (LS) probably deposited as a result of unconfined sheet flooding


Incised valleys form during Fallingstage
Highstand System Tract: isolated towards amalgamated channel fills
Fluvial aggradation
Transgression: tidally influenced, meander channels and lagoonal deposits
Fluvial aggradation towards MFS
Lowstand System Tract: amalgamated channel fils
Paleosol formation and/orf fluvial aggradation
Fallingstage System Tract: fluvial incision, terrace deposits, paleosols in interfluve areas
Paleosol formation
Braided, amalgamated channels
Meandering channels
Terrace deposits
Estuarine deposits
Lagoonal deposits
Sequence boundary



The upper part is becoming dominated with thick overbank-floodplains fines (OF)

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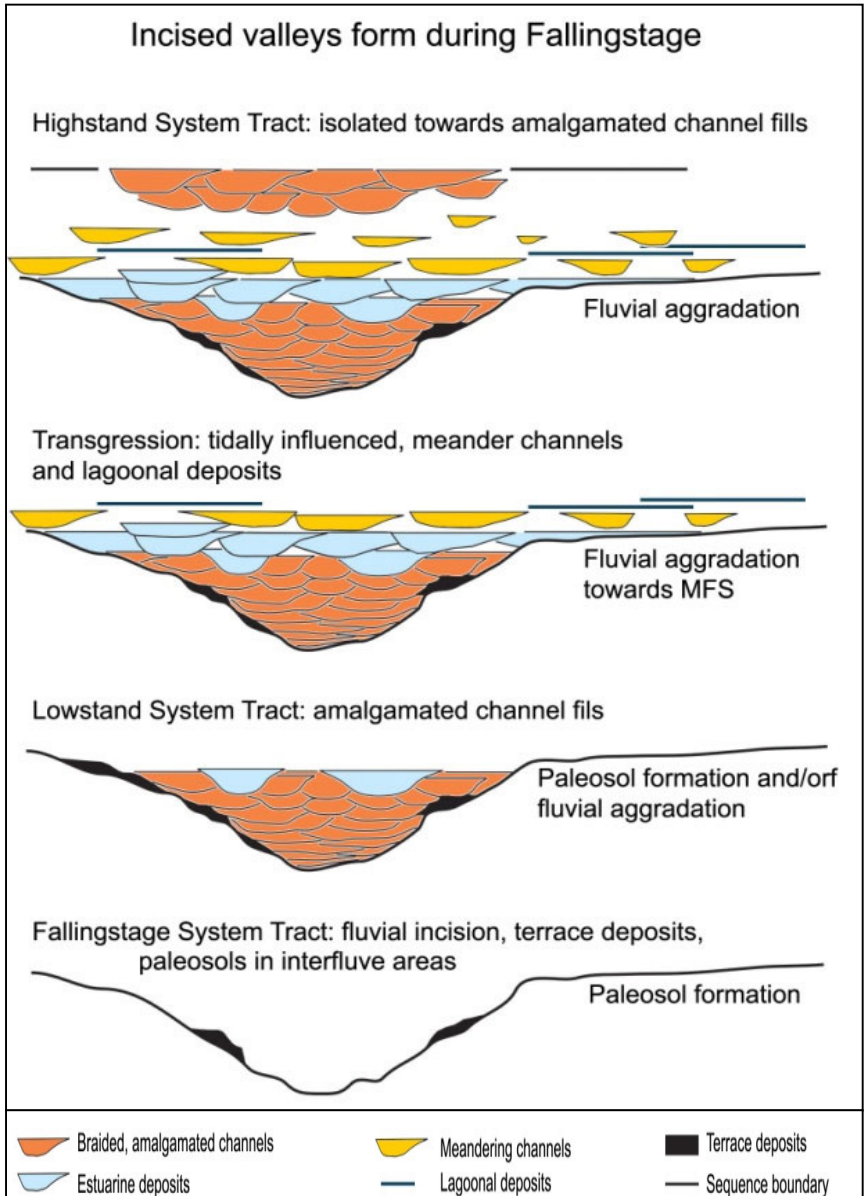
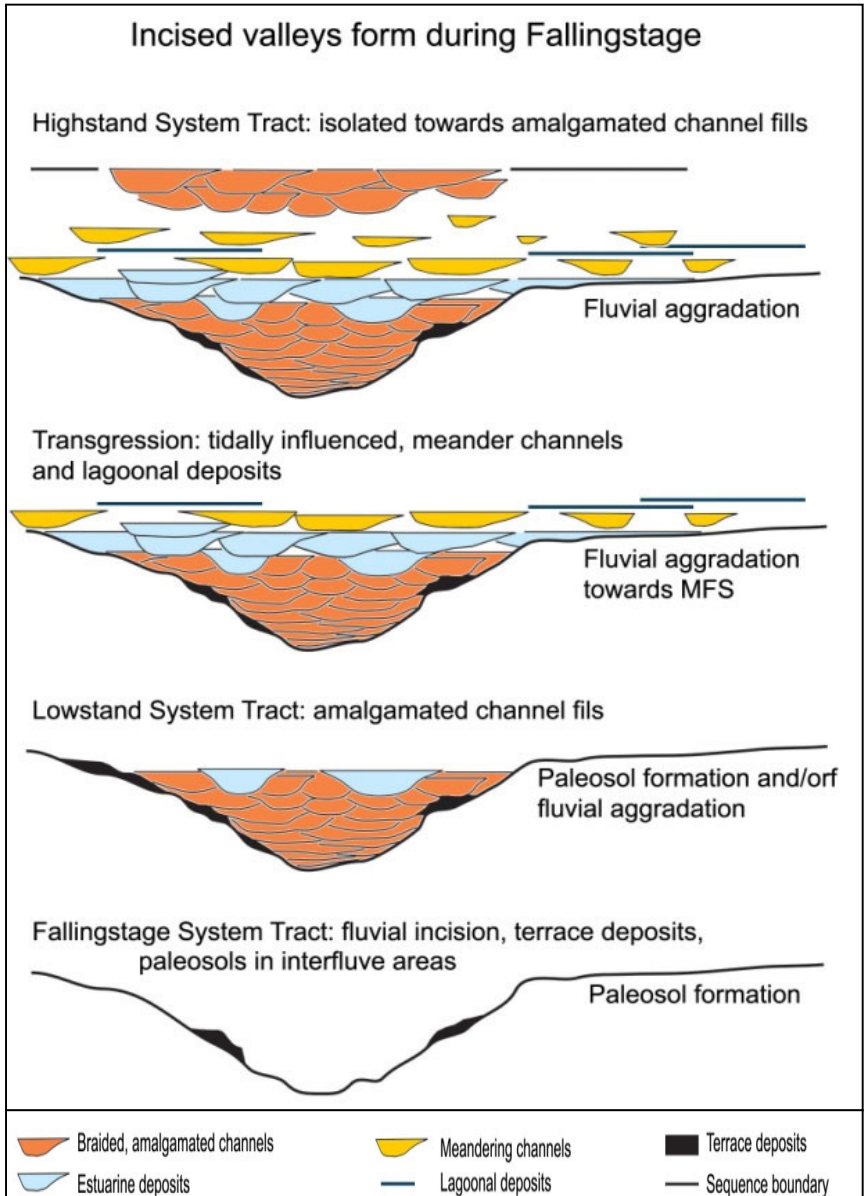
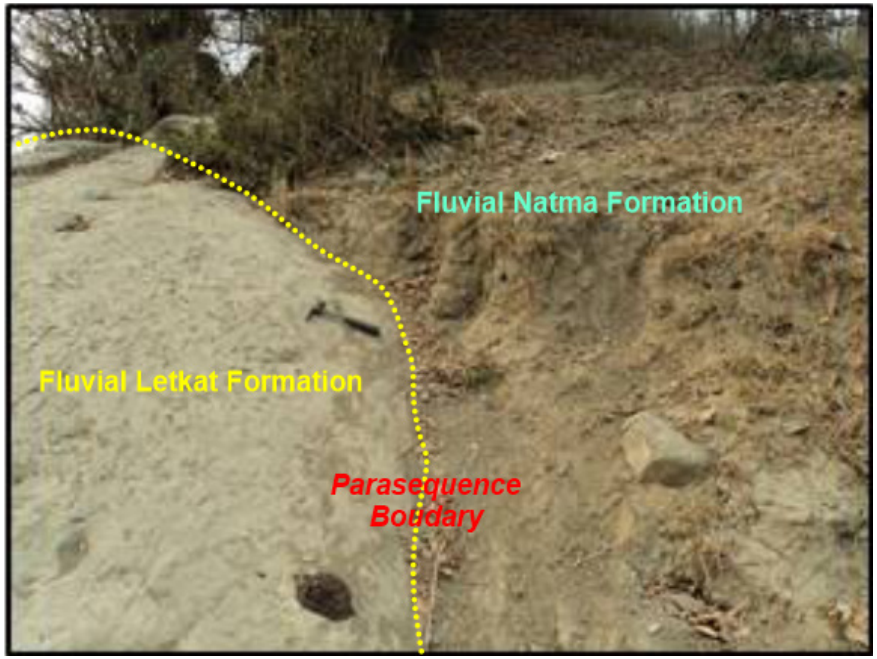
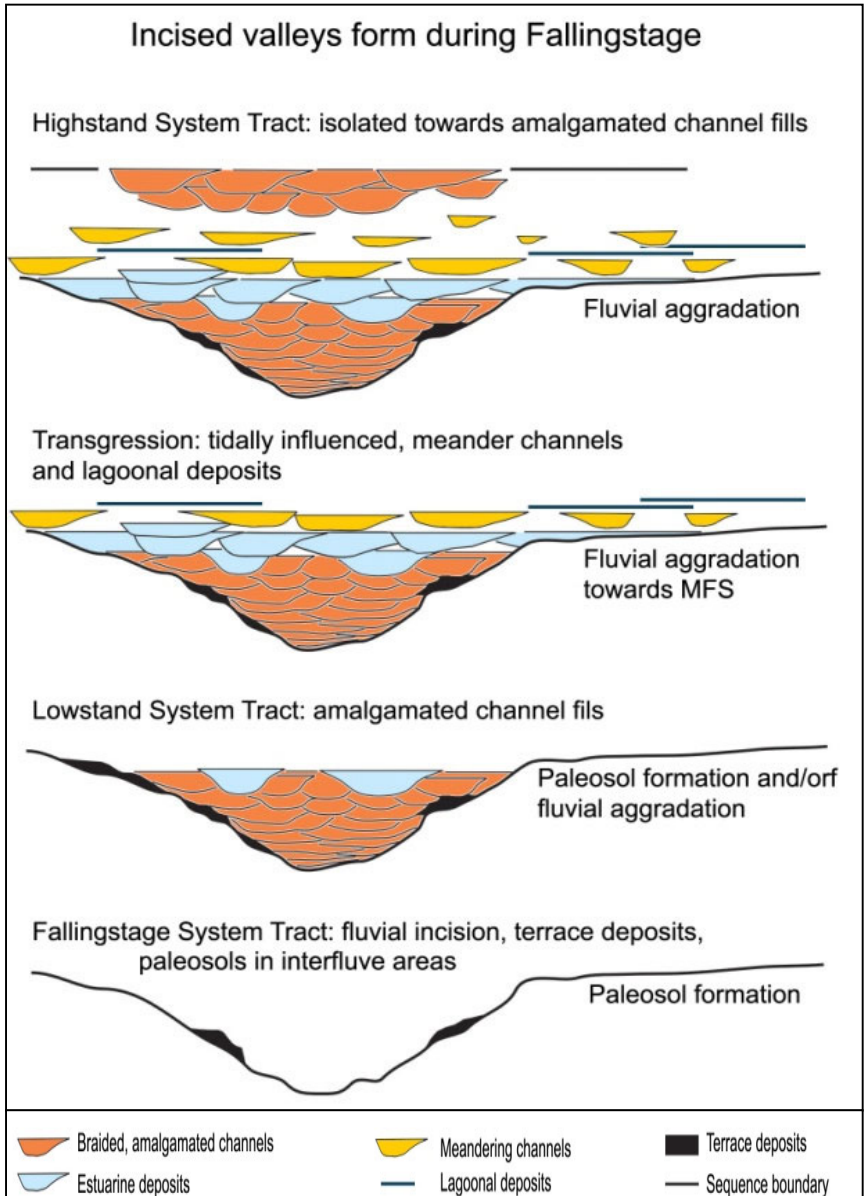


interbedded with the isolated major channels, minor channels

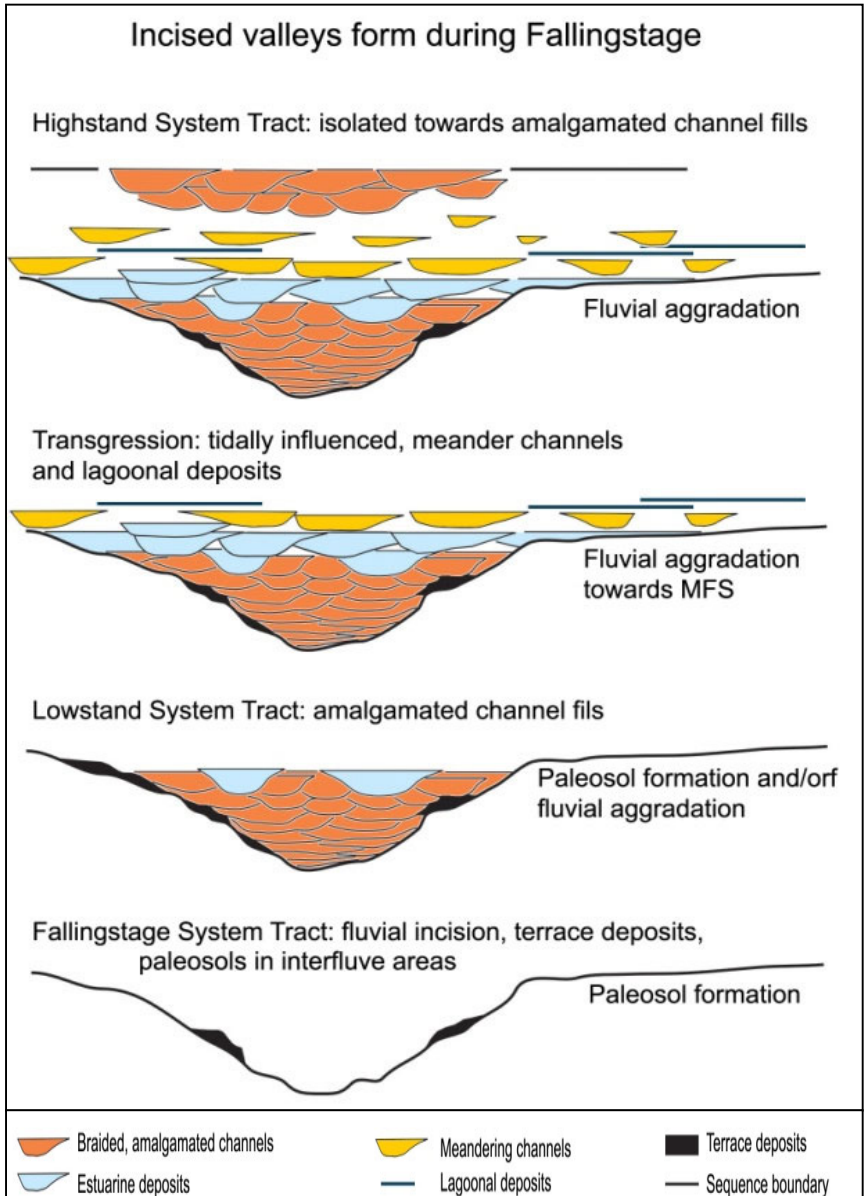




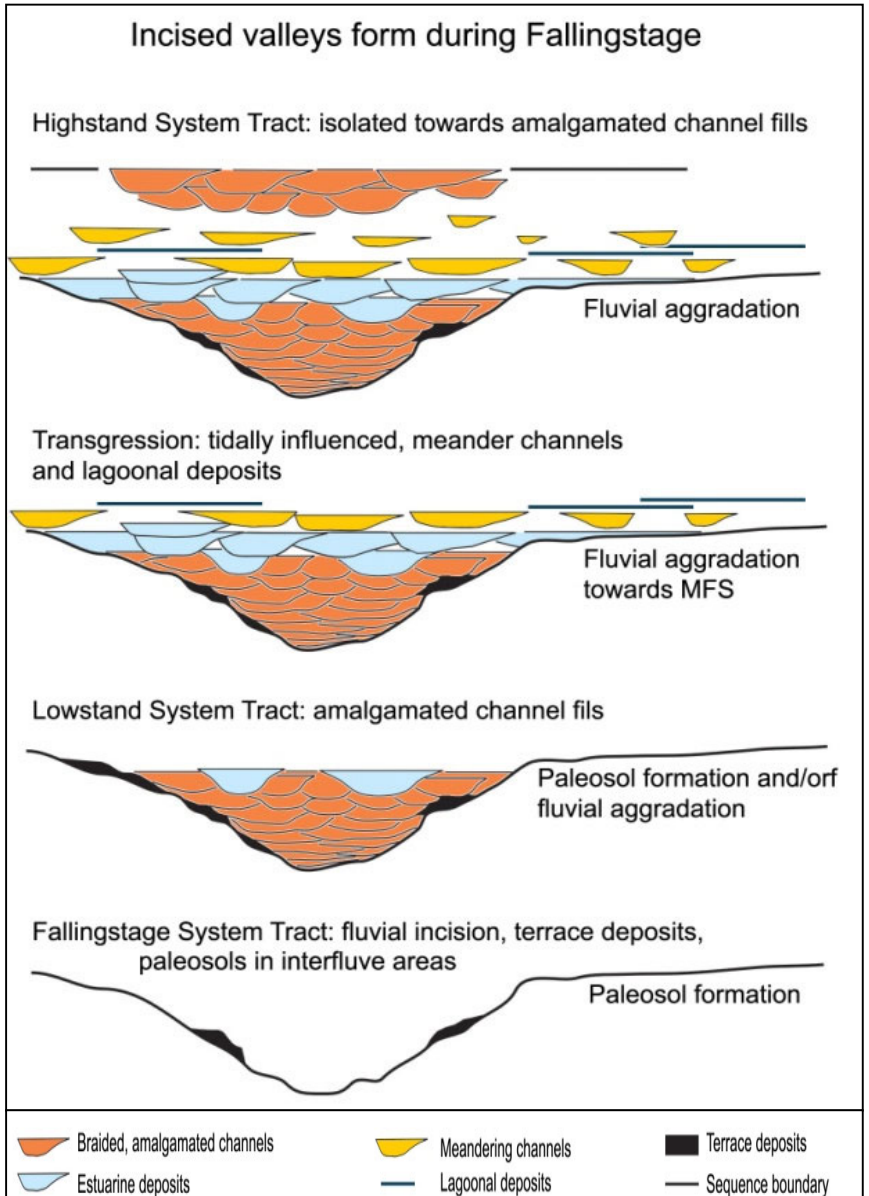
The lower part Natma Formation is becoming dominated with thick overbank-floodplains fines (OF)



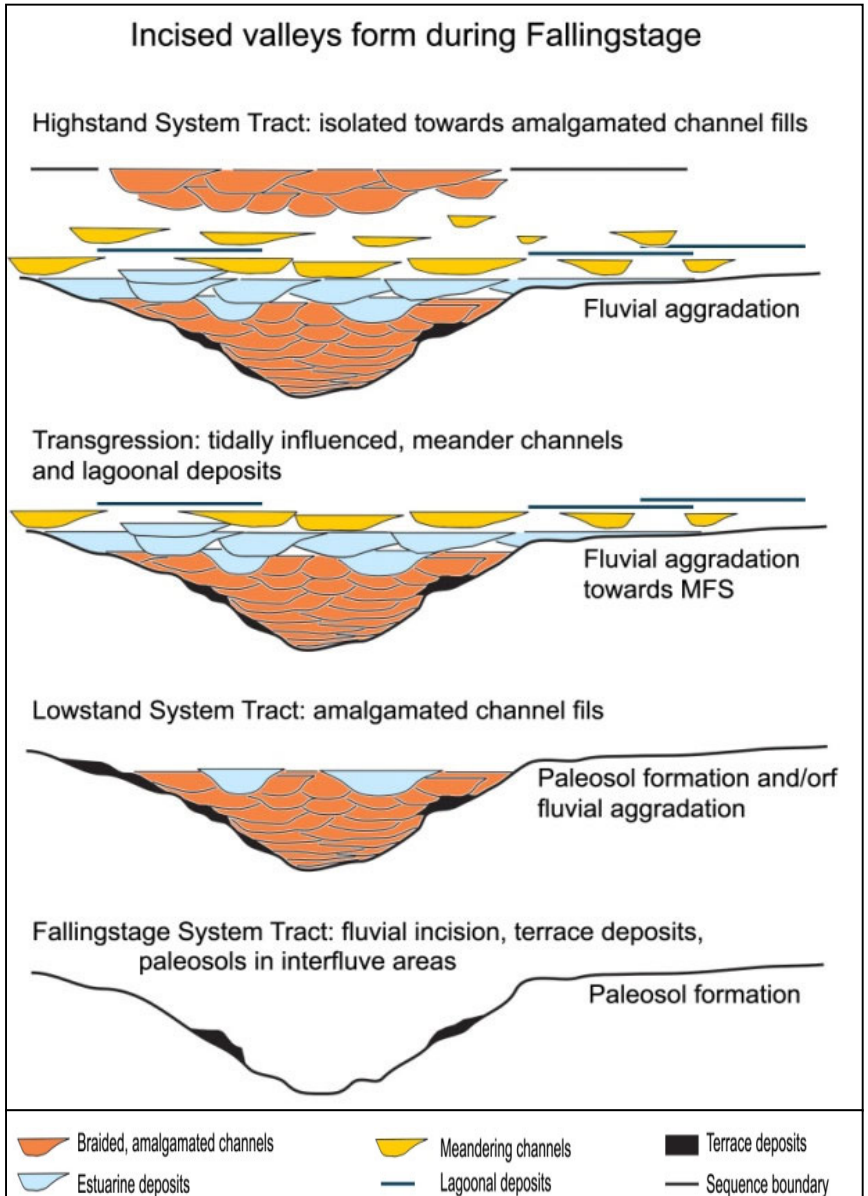
interbedded with the isolated major channels, minor channels

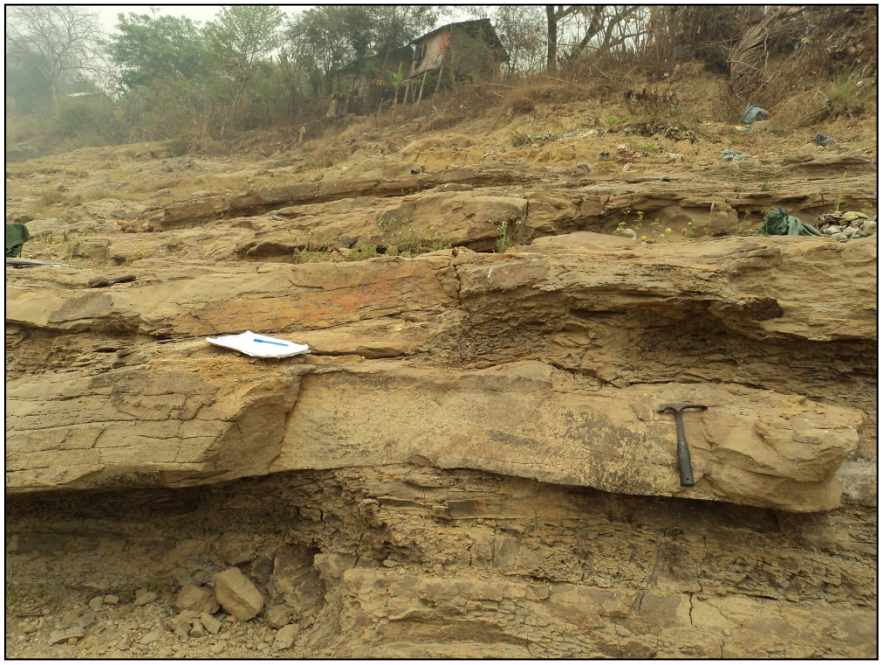


crevasse channels



The upward change in sand-body architectures within the sequence and lateral interconnected and amalgamated channel and meander belt systems with poorly preserved floodplain deposits





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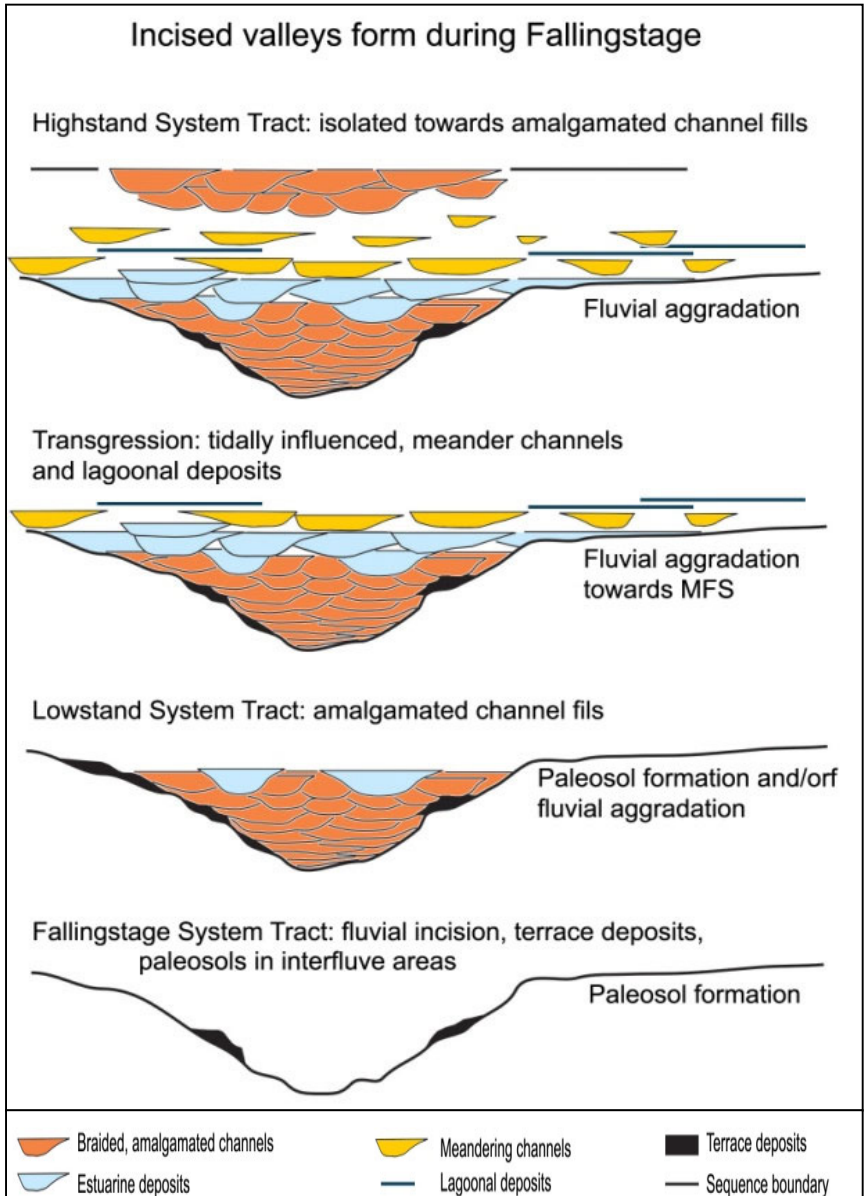
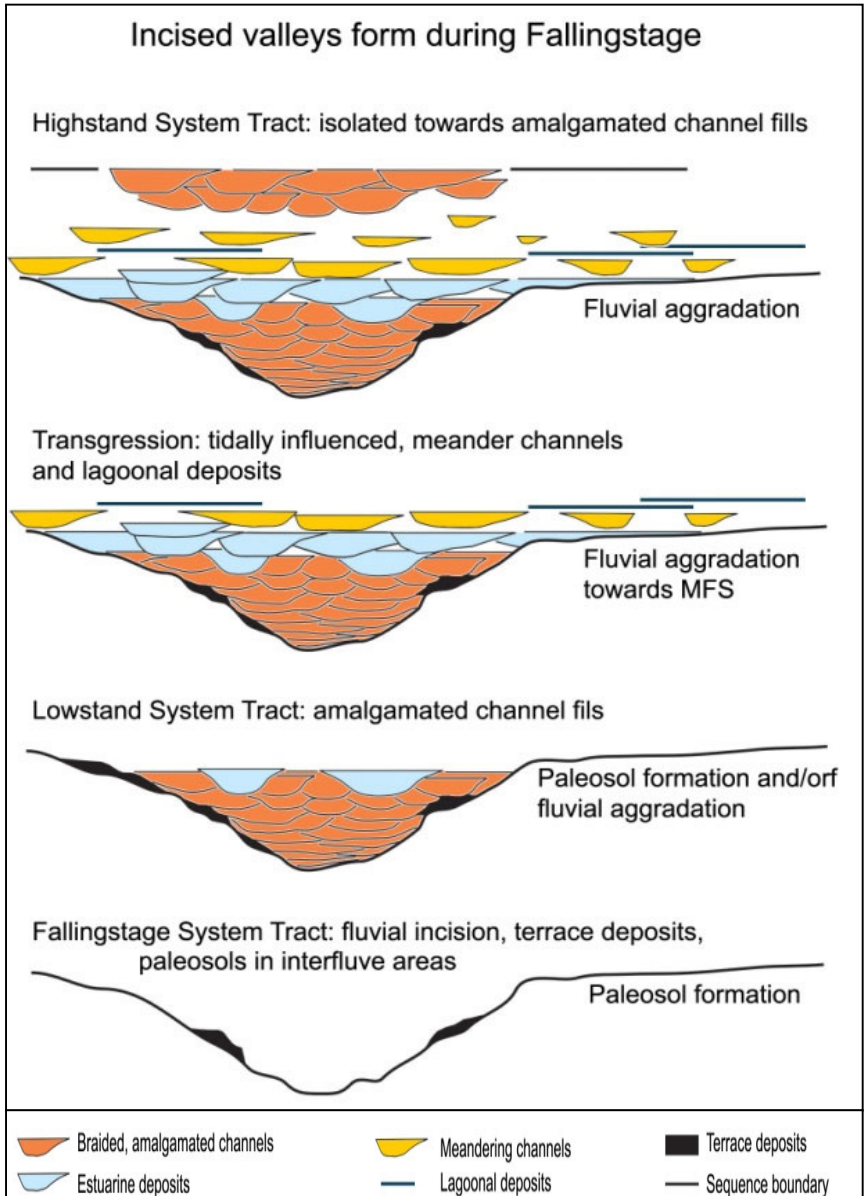
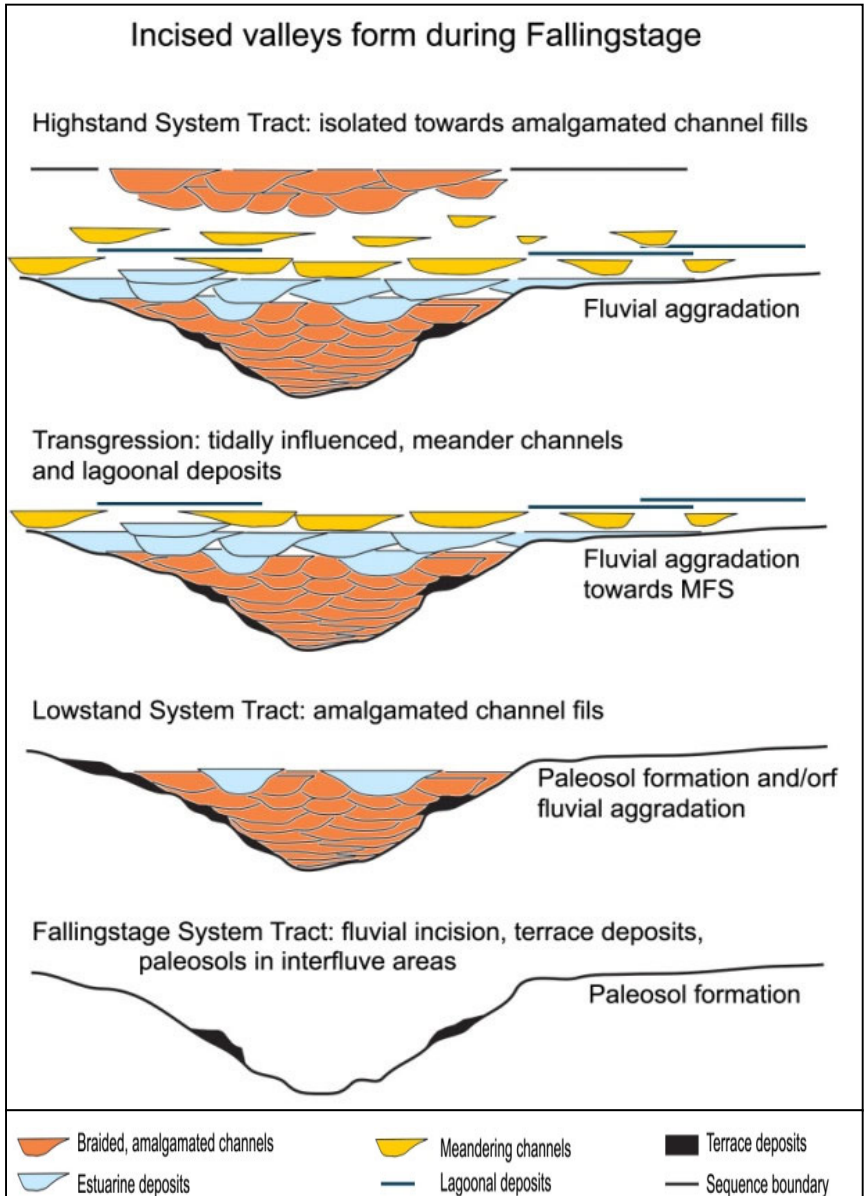


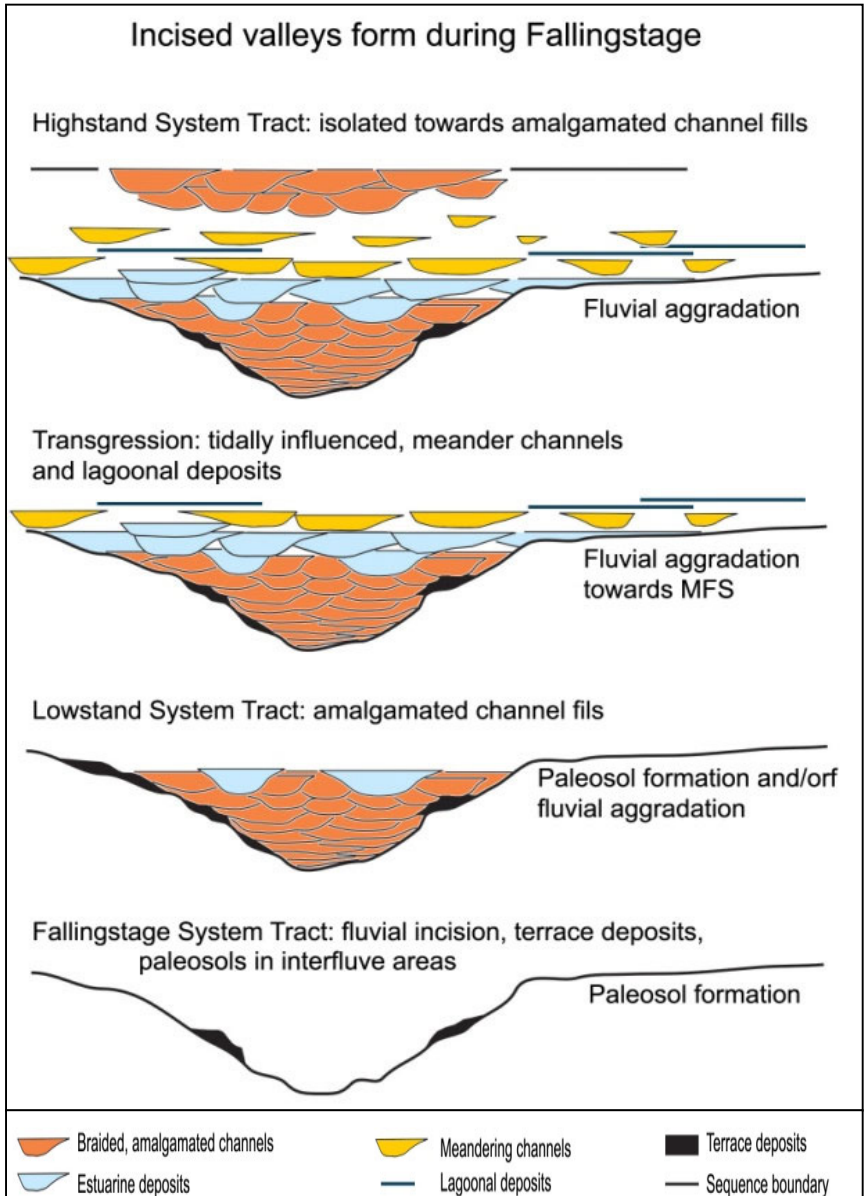
The lower part of Shwethamin Formation is characterized by



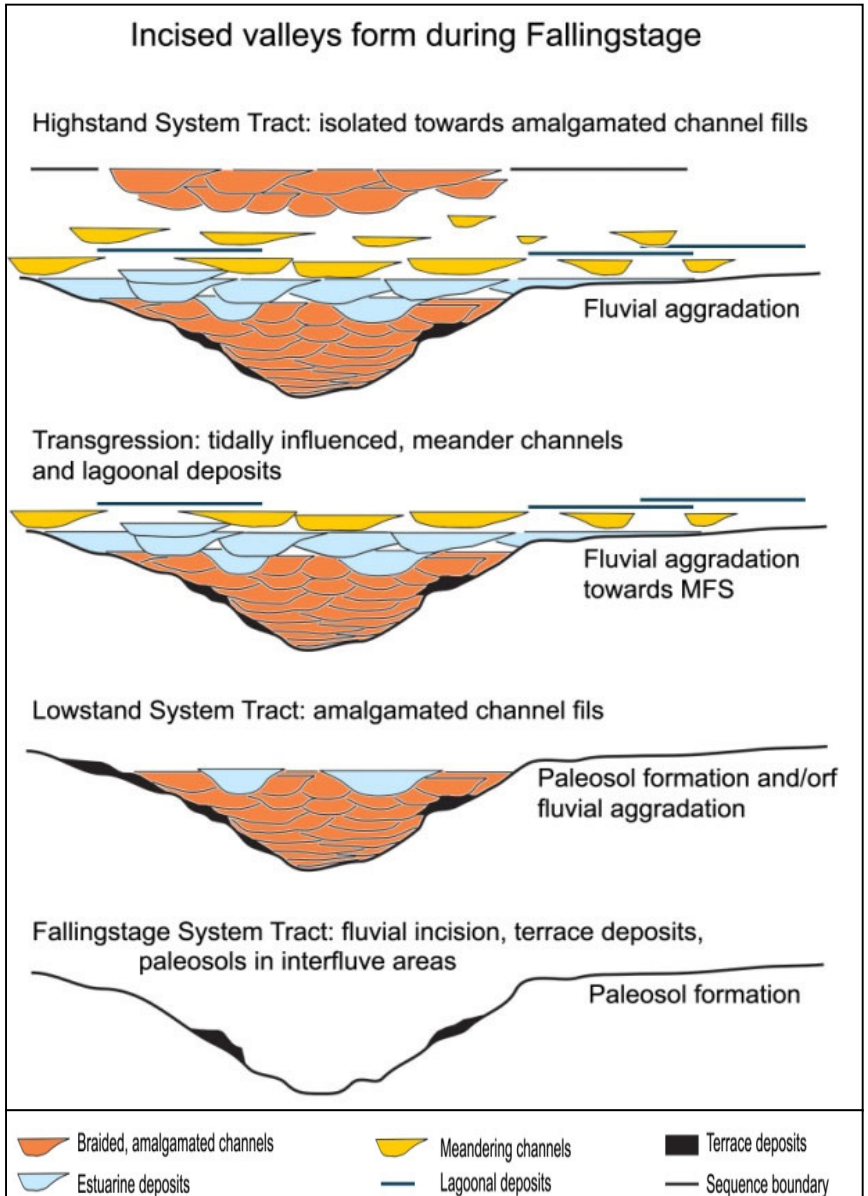
high bedload gravelly and sandy



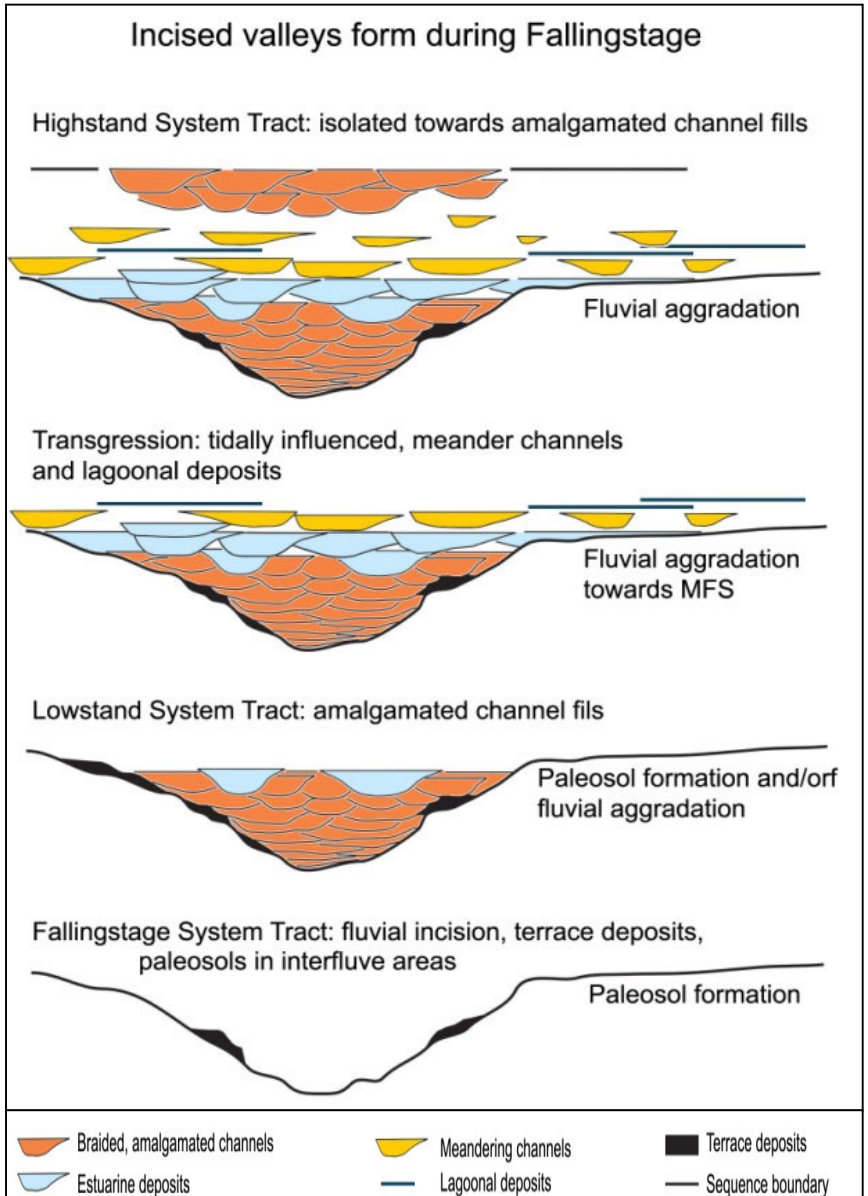
multi-story sand bodies of braided channel-complexes



The middle part is constructed with the shallow and broad amalgamated sandy channels



whereas the upper part is dominated with thick overbank-floodplains fines.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THANK YOU
FOR
YOUR KIND ATTENTION