EMCOL

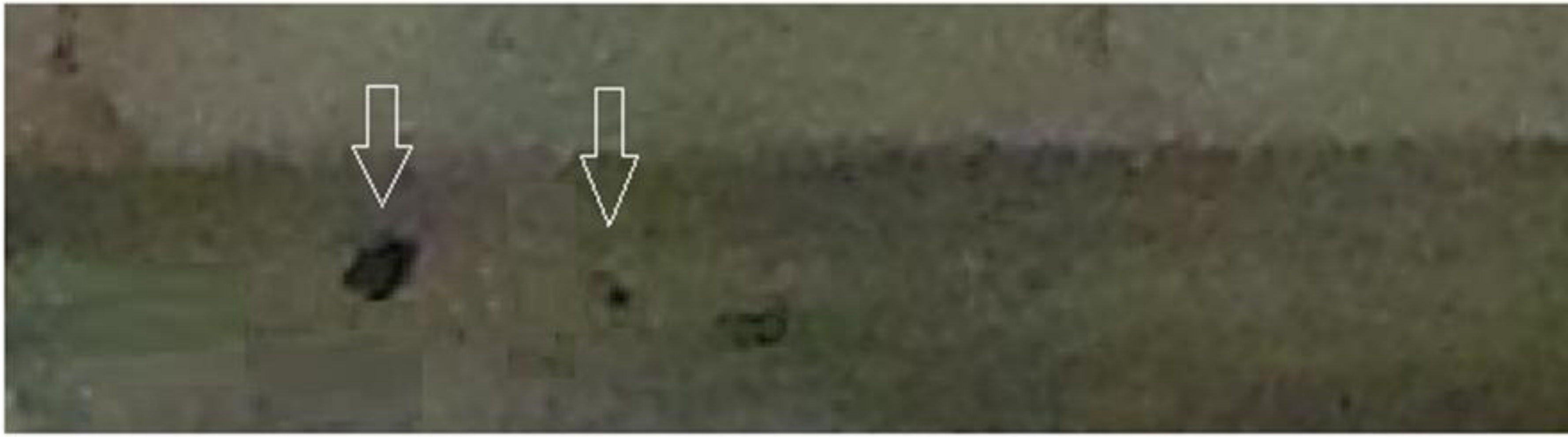
The reasons for dark patches on sediments related to decay at still water, burrow canals, and vertical carrier flows

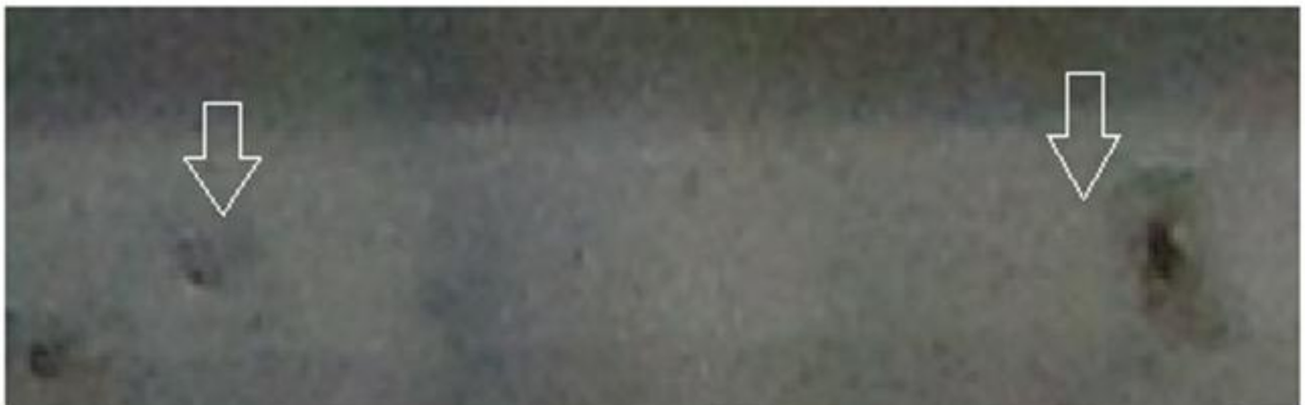
Dursun Acar1,2,3, Furkan Hoşer2, Nurettin Yakupoğlu2, İpek Olsun1, Dila Doğa Dokgöz1, and Demet Biltekin1
1Istanbul Technical University (ITU), Eurasia Institute of Earth Sciences, Istanbul, Türkiye
2Department of Geological Engineering, EMCOL Applied Research Center, Istanbul Technical University, Ayazağa, 34469 Istanbul, Türkiye
3Middle East Technical University (METU),Institute of Marine Sciences , Erdemli-Mersin, Türkiye

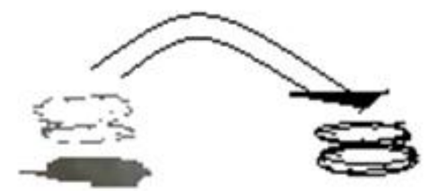
Anoxic conditions at surface sediments with continious natural environmental cycles : Black carbon (non oxidised) + oil + oil acids + clay
Still water with anoxic buried stable sediments until when surfaced with oxic condition: quick weak bounds of carbon iand ts diffision to clay

Session: SSP3.2 – Limnogeology meets Marine Sedimentology - the geological record of sedimentary archives

Dark patches at the oxic conditions (Sediment core)







- For a long time Decayed remnants sitting at same places such as plants insects
- For a long time sitting shells (muscel) area is anoxic between touching shell surface to seafloor and sediments
- FeS mienerals inorganic or organic processed
- Greigite and mangan enriched surfaces

Dark patches generally related by anoxic conditions

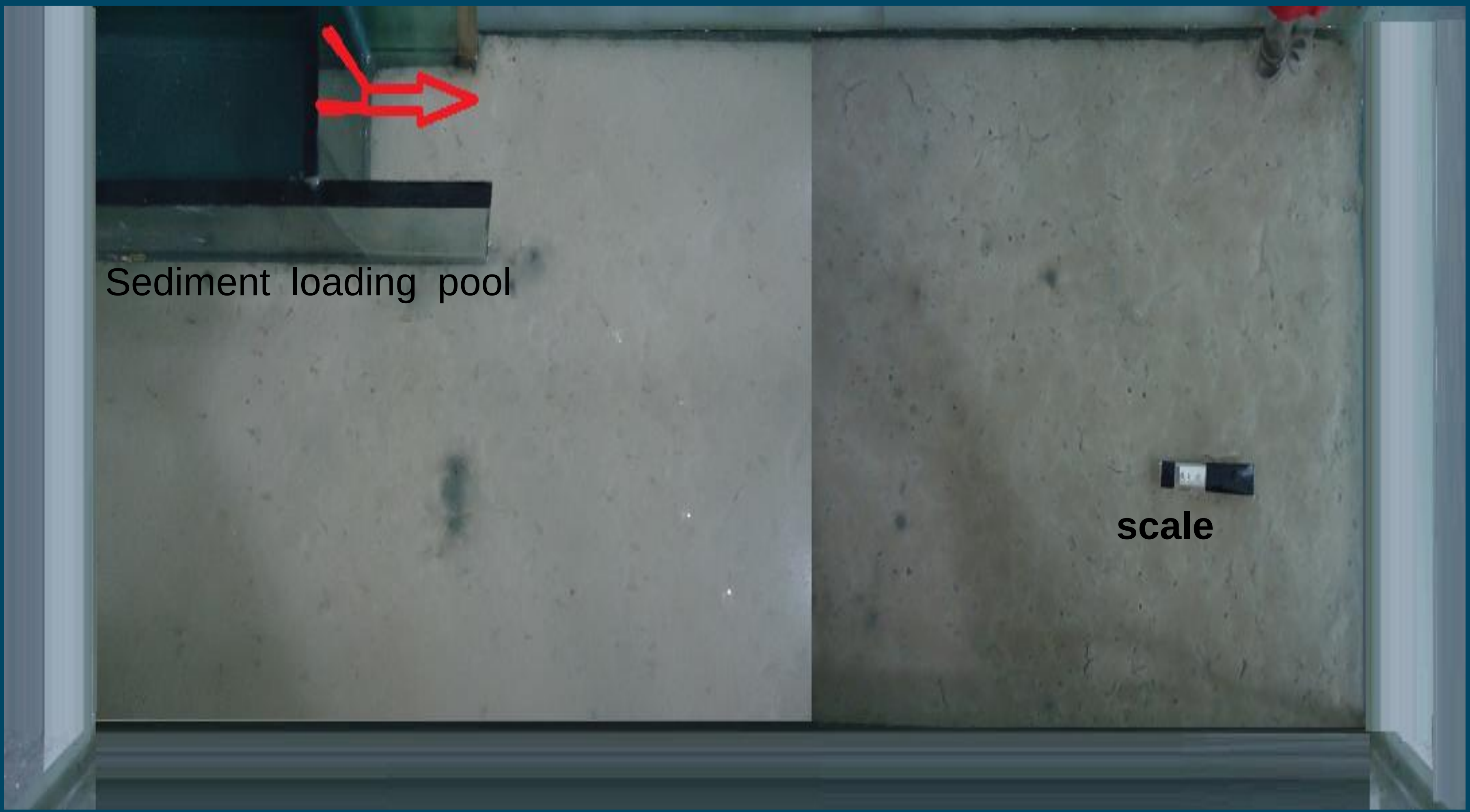
- Anoxic sediments when surrounded with oxic waters
- --Dark sediments regionally rounded by well oxidification (more light colored)
- Anoxic sediments from bottom layer when disturbed with physical conditions
- -- Tectonics , Salt dome deformation , opening and closing Fault cracks , P-wave damage with fluid hammering
- ---increasing heat
- Dark patches with nodules as minerals Pyrite , Geigite ,Mackinawite , Marcasite , Pyrhotite

- # Primer factors
- **Chemistry** of water and sediments chemical zonations
- **Physical specifications** water, sedimentary basin and sediment deform by tectonics, **Sedimentation** rate and heavy sediment layer or mass load on bottom layer , p-wave conductivity

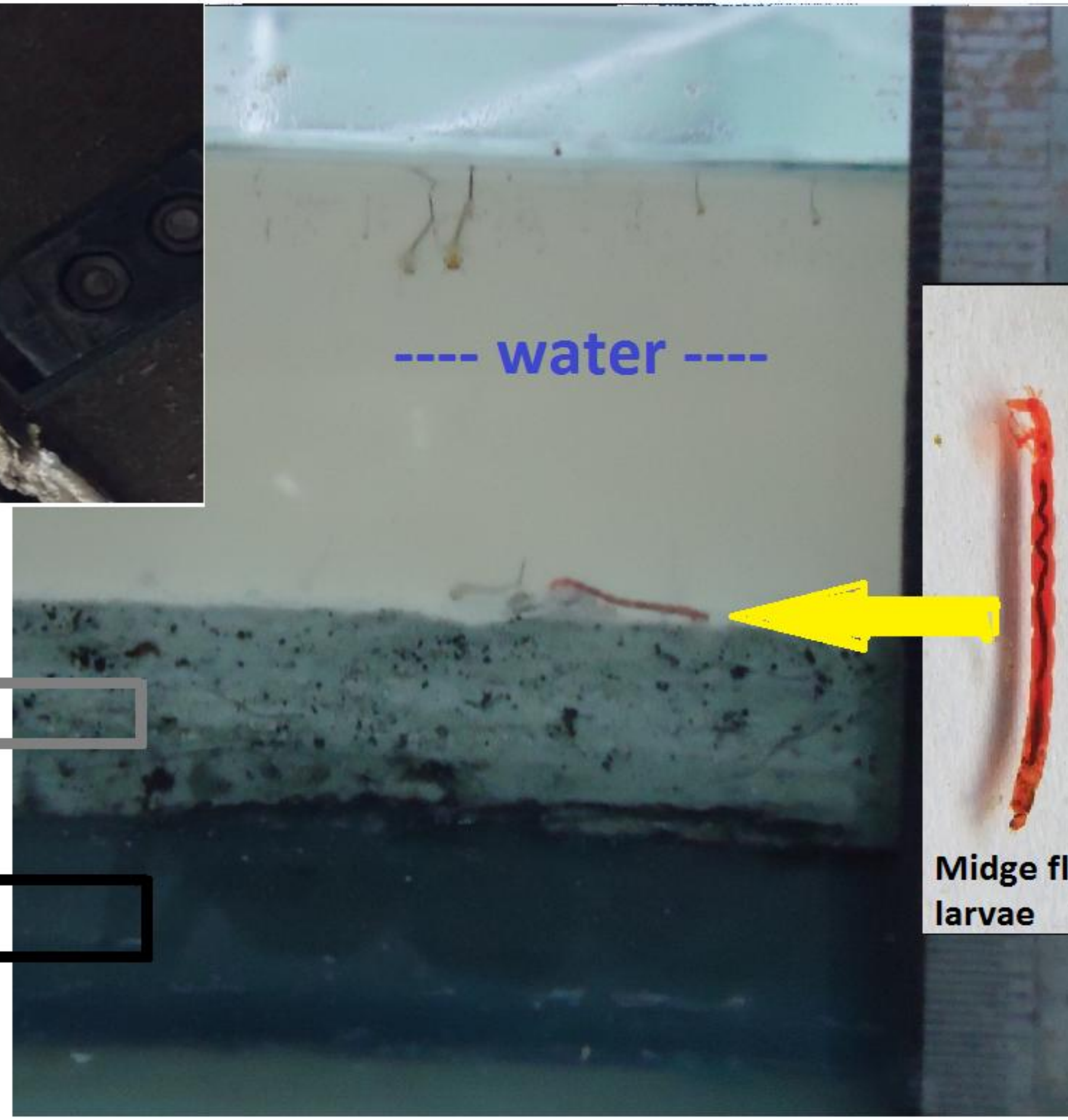
- # Seconder factors
- All related both primer factors
- **Biogenic** activity

- Depth of permitted bio – turbation and its structures by sedimentation rate
- Decaying of biologic remnants
- Pore water and particles carried with its pressure front escapes from anoxic sediment layer
- Enough soft sediment density for migration of mineral builder molecules and particules for new mineralization or diagenesıs

Experiments type 1 and sediment core observations



Visitors of nature and experiment layers



Mosquito and midge fly

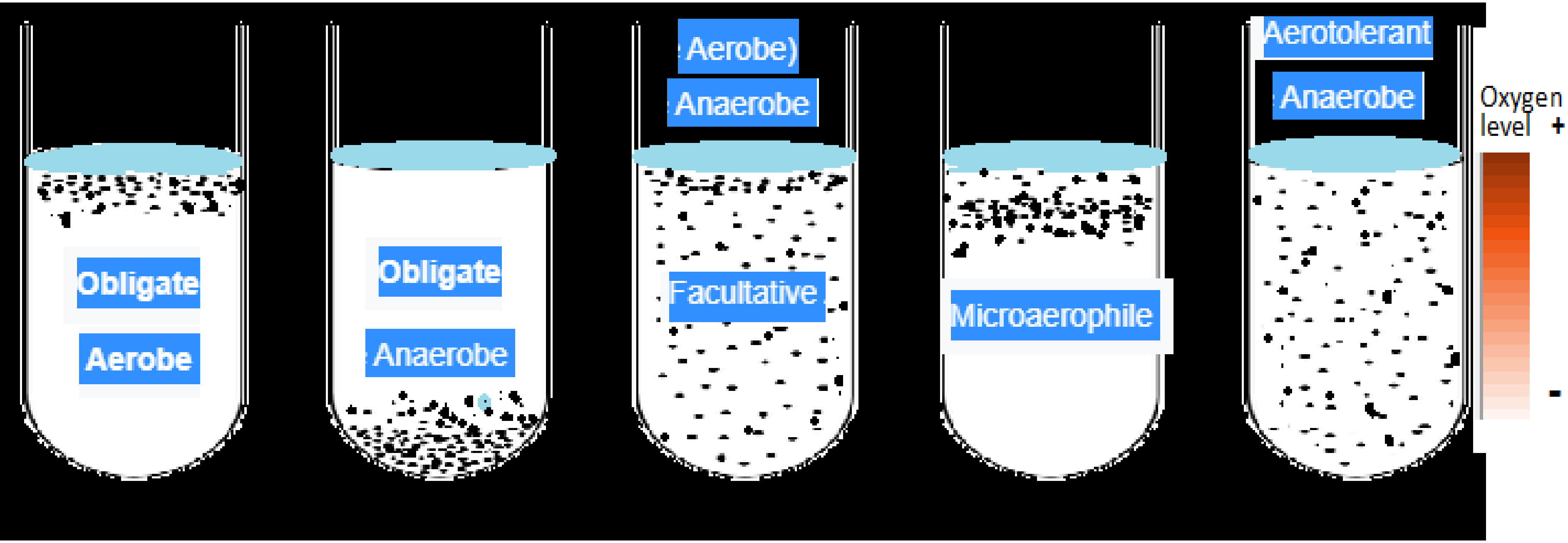
oxic sediment

Anoxic sediment

httpsmdc.mo.gov discover-nature field-guide midge-fly-larvae

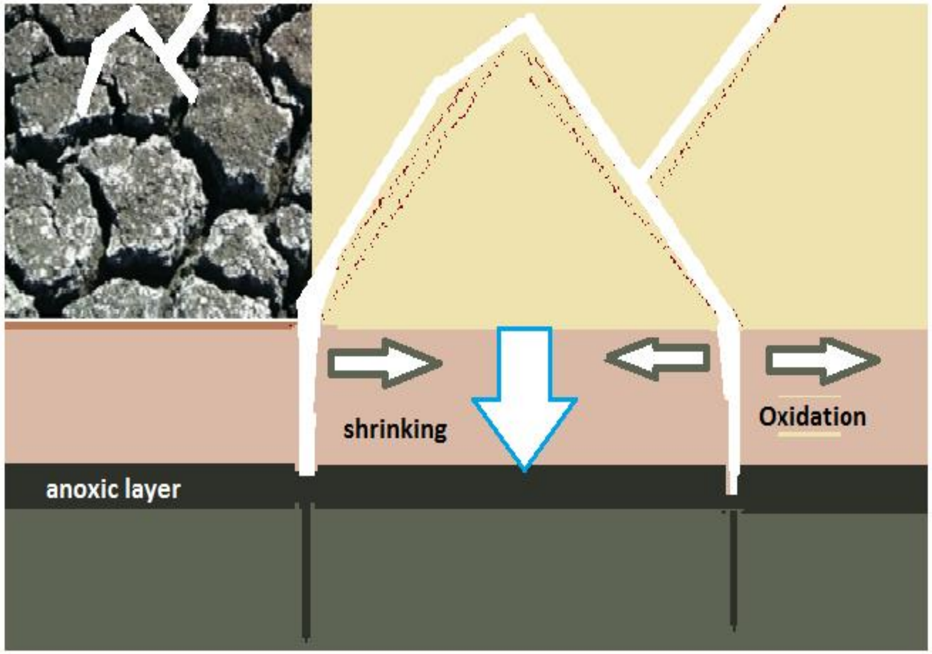
- **(high mass load of fast sedimentation rate of last covering layer provides high pressure on pore water at bottom layers)**
- **Tectonic stress or bioturbation canals (will be experienced under p-wave) can help to fluid escapes , especially after or before earthquake , compression or opening fault gap**
- **Sediment environment transitions between anoxic and oxic conditions**
- **Bioturbation canals has low oxygen ratio and low water circulation supports life at anoxic condition**

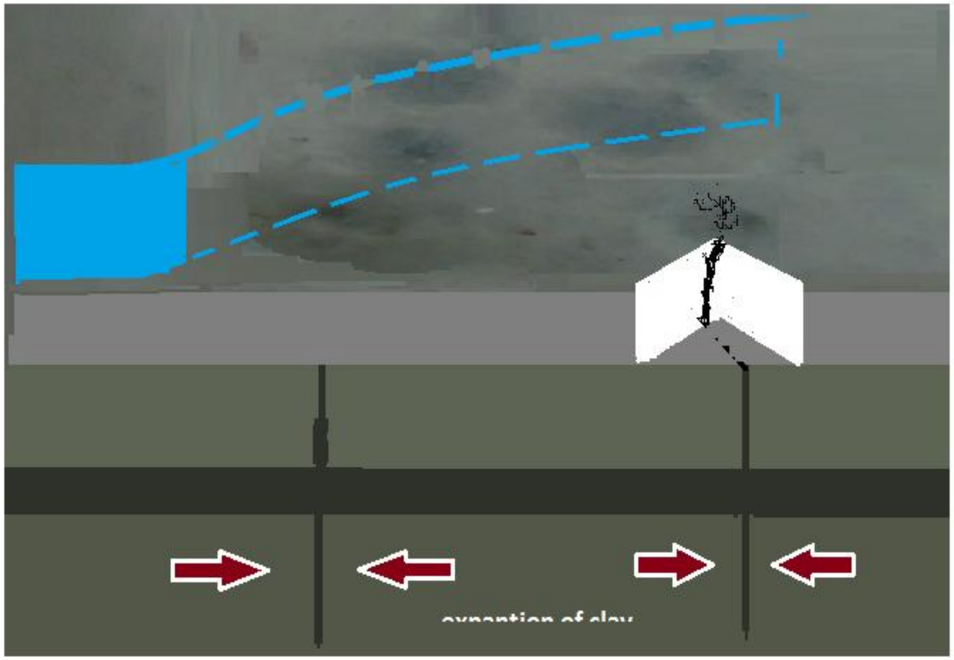
Anoxia – oxic conditions on life

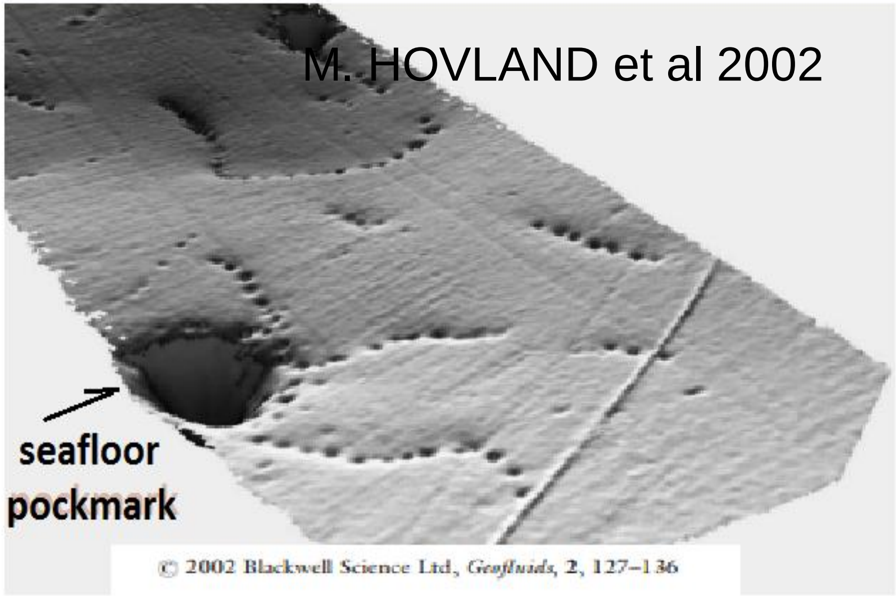


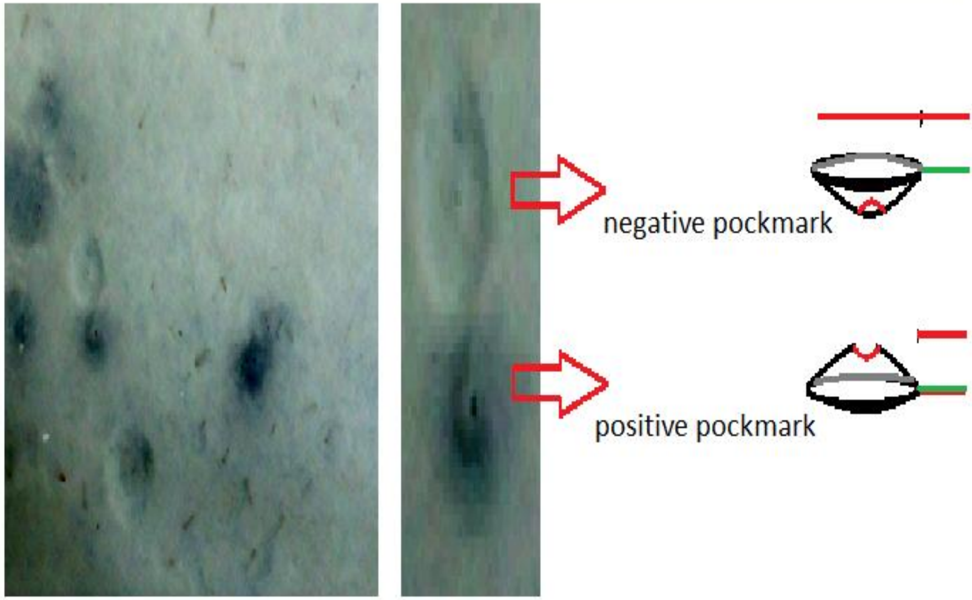
Group	Environment		O_2 Effect
	Aerobic	Anaerobic	
Obligate Aerobe	Growth	No growth	Required (used for aerobic respiration)
Obligate Anaerobe	No growth	Growth	Toxic
Facultative Anaerobe (Facultative Aerobe)	Growth	Growth	Not required for growth but used when available
Microaerophile	Growth if level is not too high	No growth	Required but at levels below 0.2 atm
Aerotolerant Anaerobe	Growth	Growth	Not required and not used

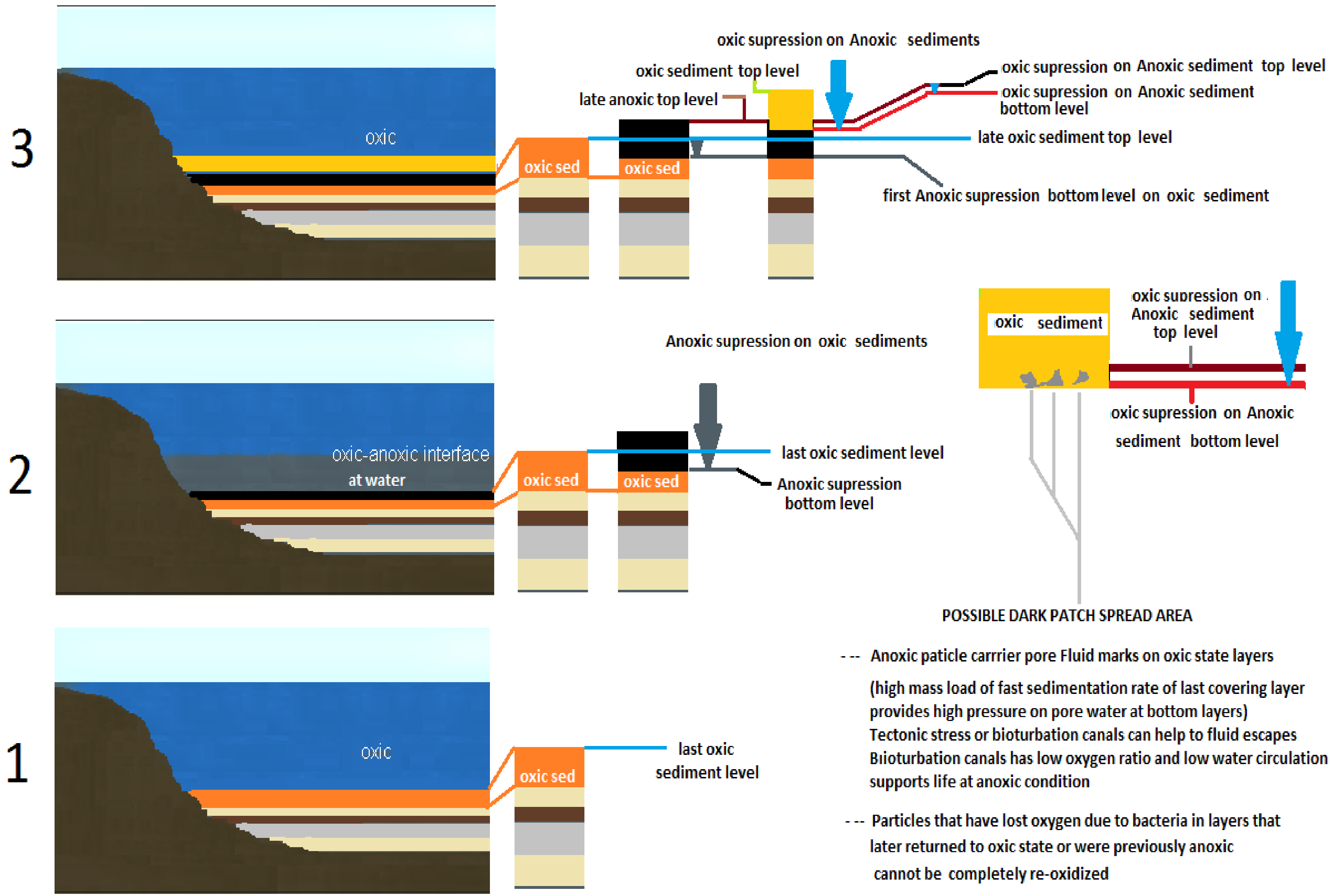
Fluid movements inorganic organic physical catalysis gas water thermal bacterial



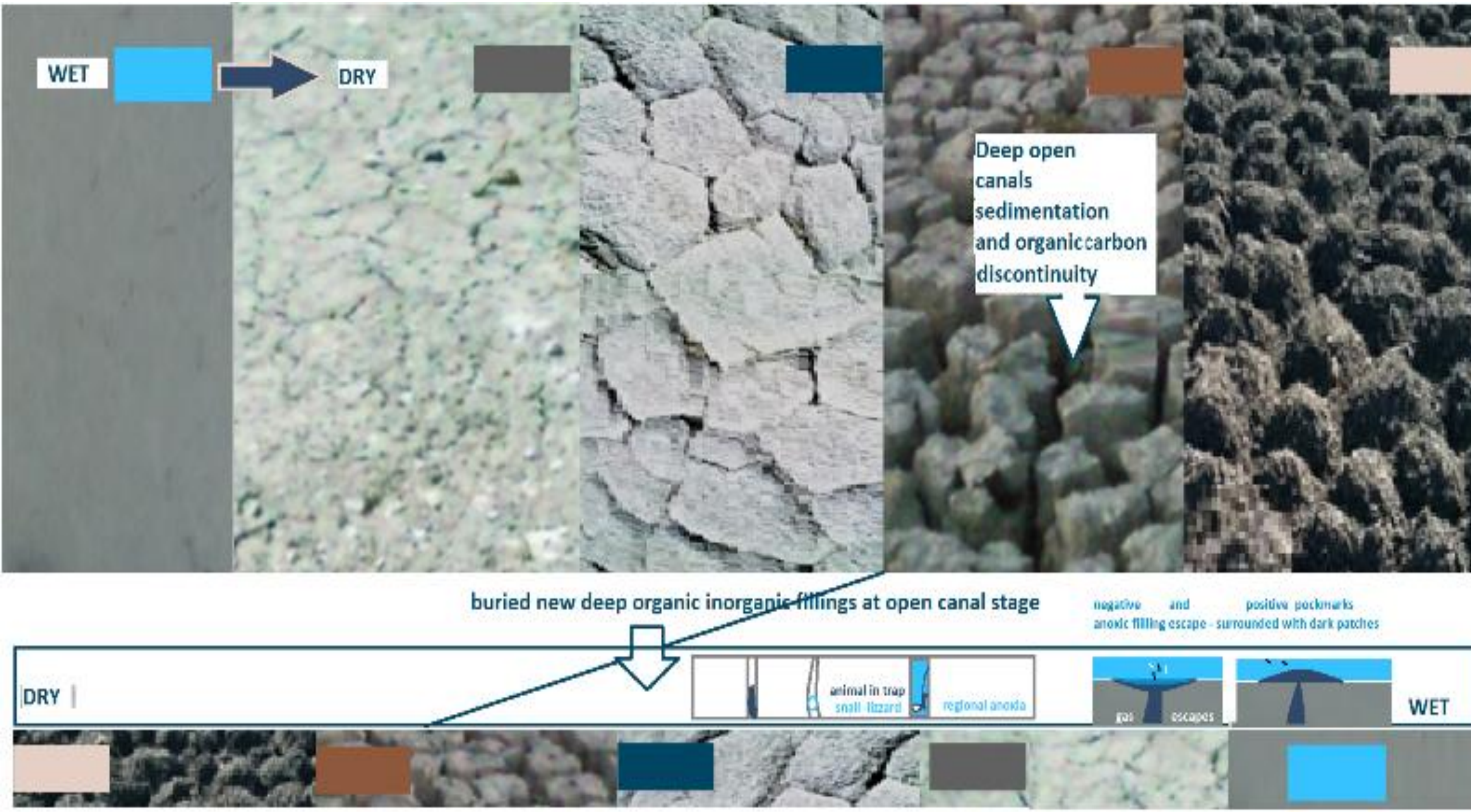






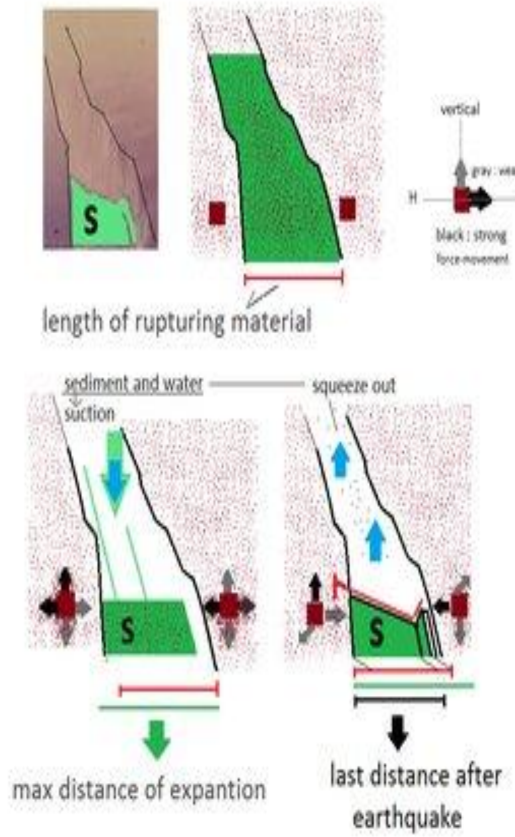

3
oxic
oxic sed
oxic sed
oxic supression on Anoxic sediments
oxic sediment top level
late anoxic top level
oxic supression on Anoxic sediment top level
oxic supression on Anoxic sediment bottom level
late oxic sediment top level
first Anoxic supression bottom level on oxic sediment
2
oxic-anoxic interface at water
oxic sed
oxic sed
Anoxic supression on oxic sediments
last oxic sediment level
Anoxic supression bottom level
oxic sediment
oxic supression on Anoxic sediment top level
oxic supression on Anoxic sediment bottom level
POSSIBLE DARK PATCH SPREAD AREA
1
oxic
oxic sed
last oxic sediment level
- -- Anoxic paticle carrrier pore Fluid marks on oxic state layers
(high mass load of fast sedimentation rate of last covering layer provides high pressure on pore water at bottom layers)
Tectonic stress or bioturbation canals can help to fluid escapes
Bioturbation canals has low oxygen ratio and low water circulation supports life at anoxic condition
- -- Particles that have lost oxygen due to bacteria in layers that later returned to oxic state or were previously anoxic cannot be completely re-oxidized

Sediments with dry wet seasons fluid escapes

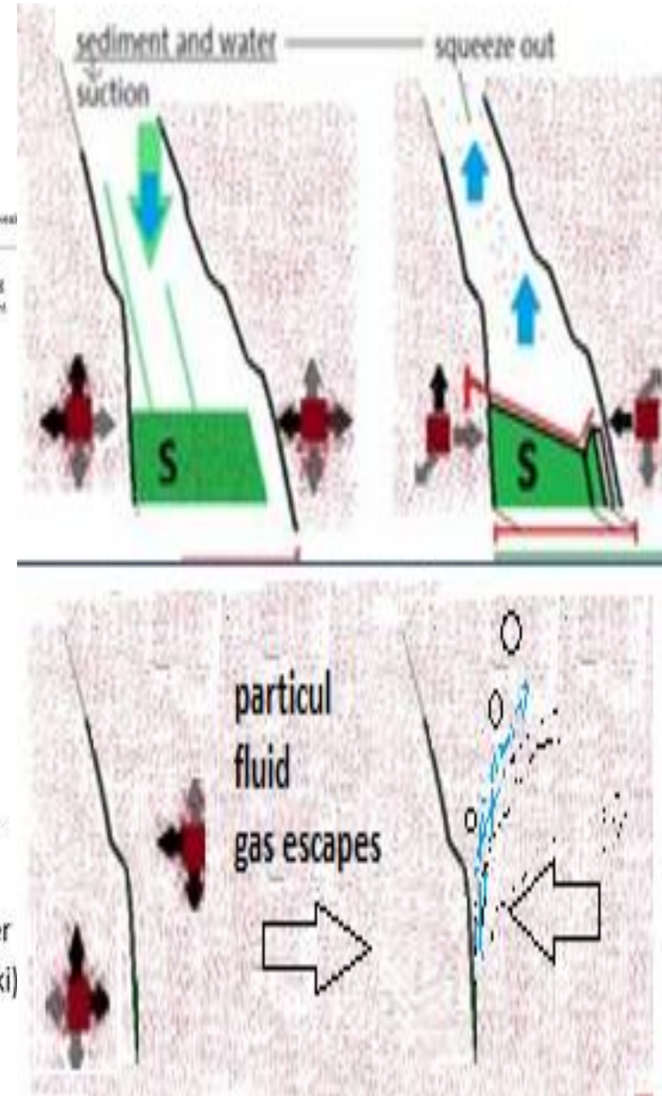


- Dry and wet climate cracks and covers are best places for well dispersed fluid gas escapes and regional anoxia (depth of cracks is important)

Tectonic seafloor faults

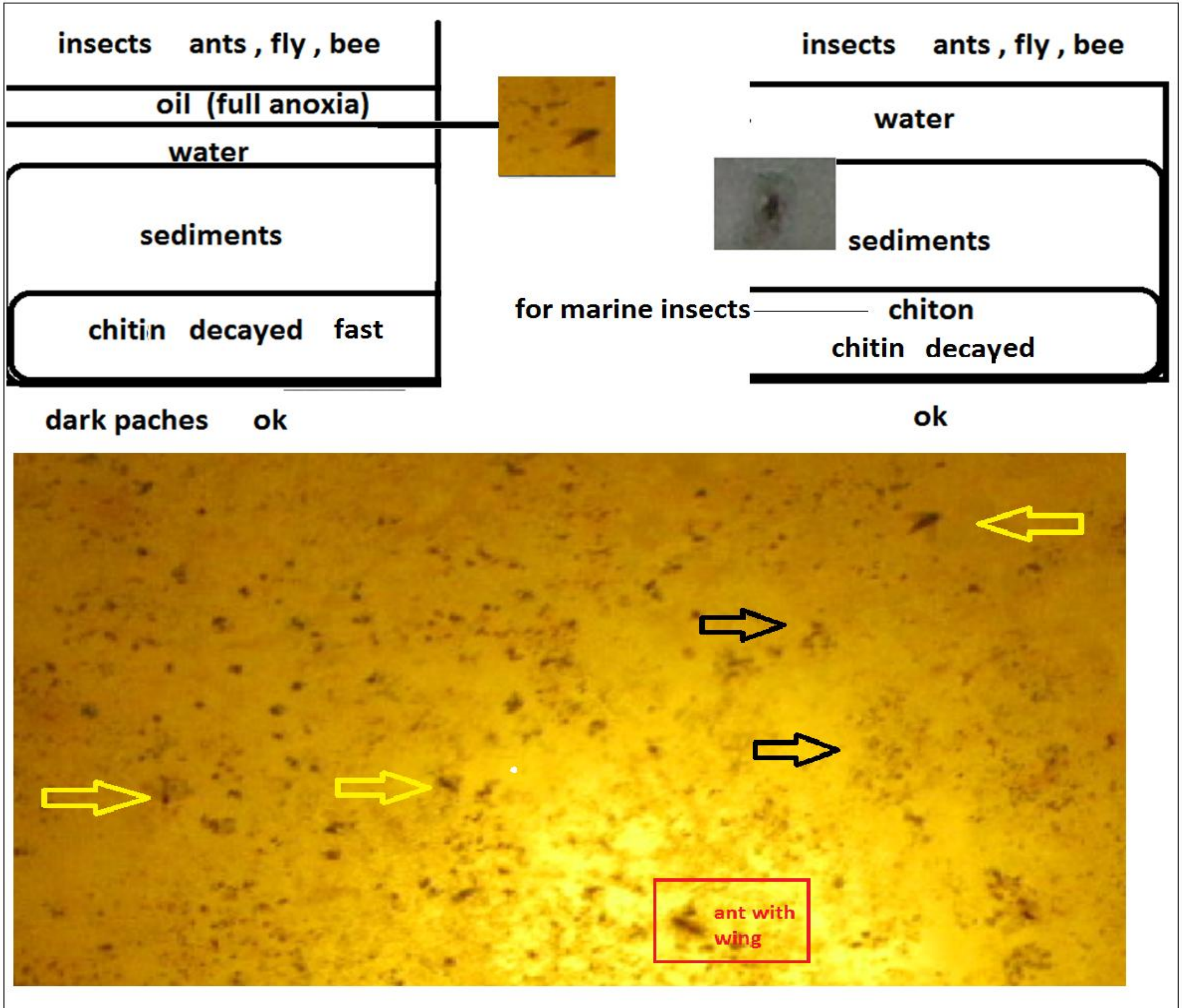


S hanged sediment block in japan trench after great east Japan earthquake 2011 (Tohoku-oki)



Tohoku -oki eartquake related fissure (sediment surface fault) at 5000 meter east of Sanriku coastline (japan) video-photo :JAMSTEC

Anoxia with oil experiments type 2

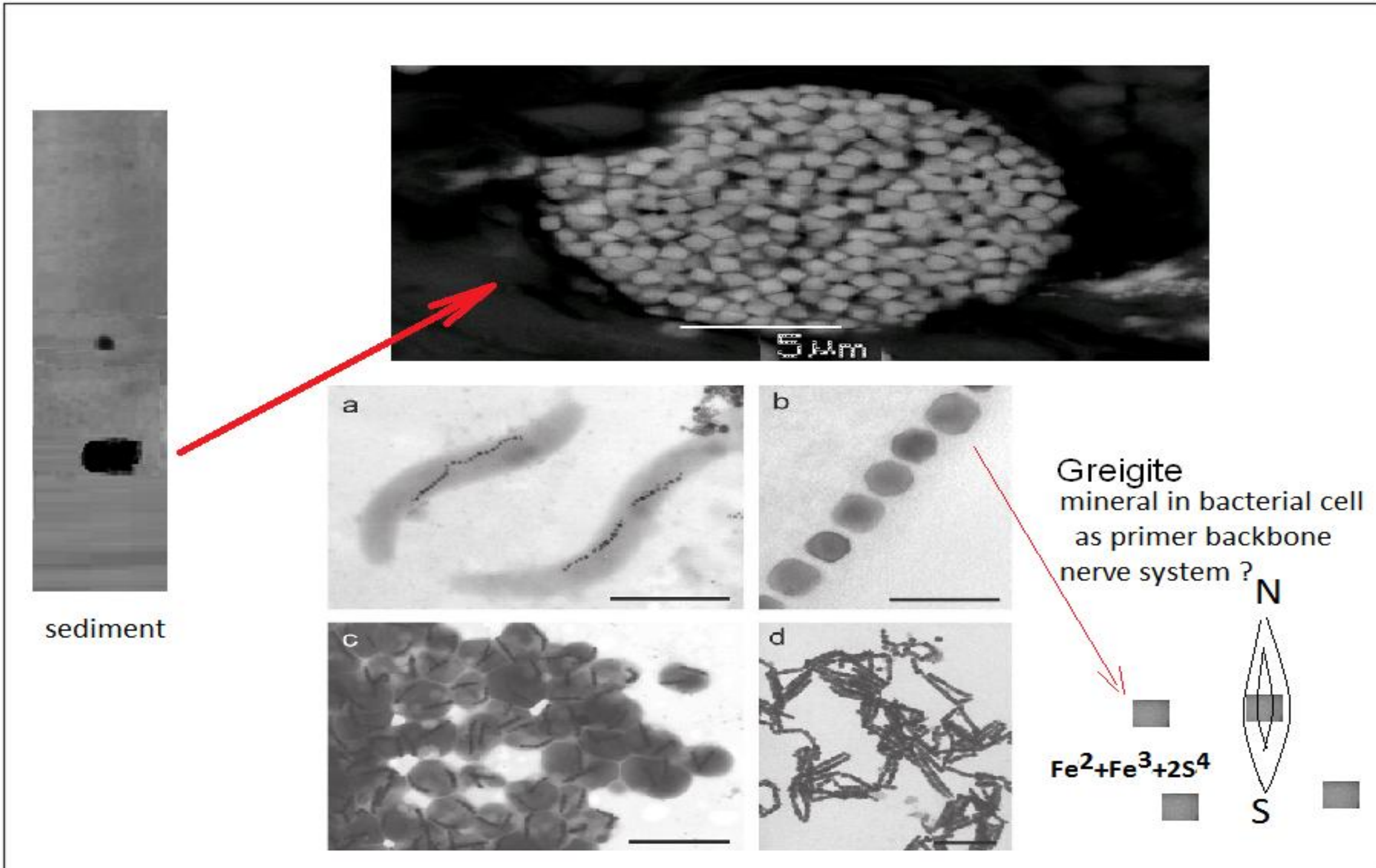


hydrohloric acid
sulphuric acid
phosphoric acid
formic asit
trichloroacetic acid

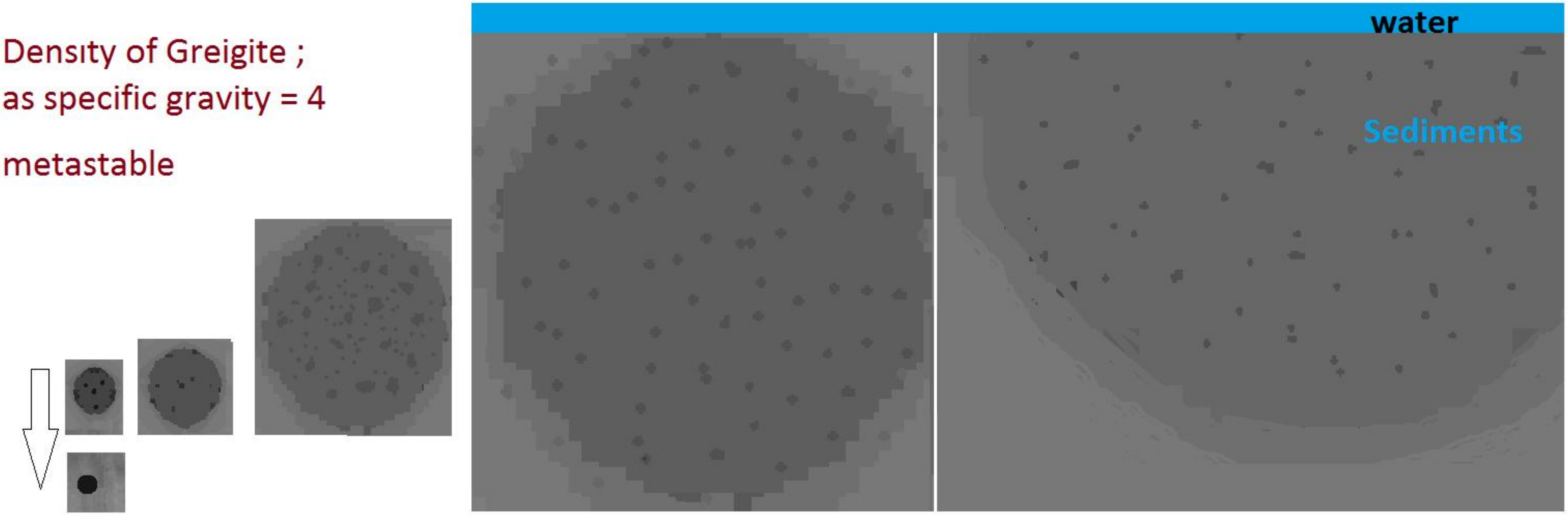
insects still at their form

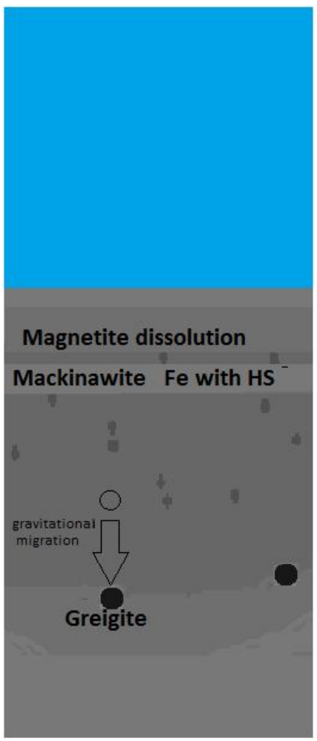
dispersed chitin particles

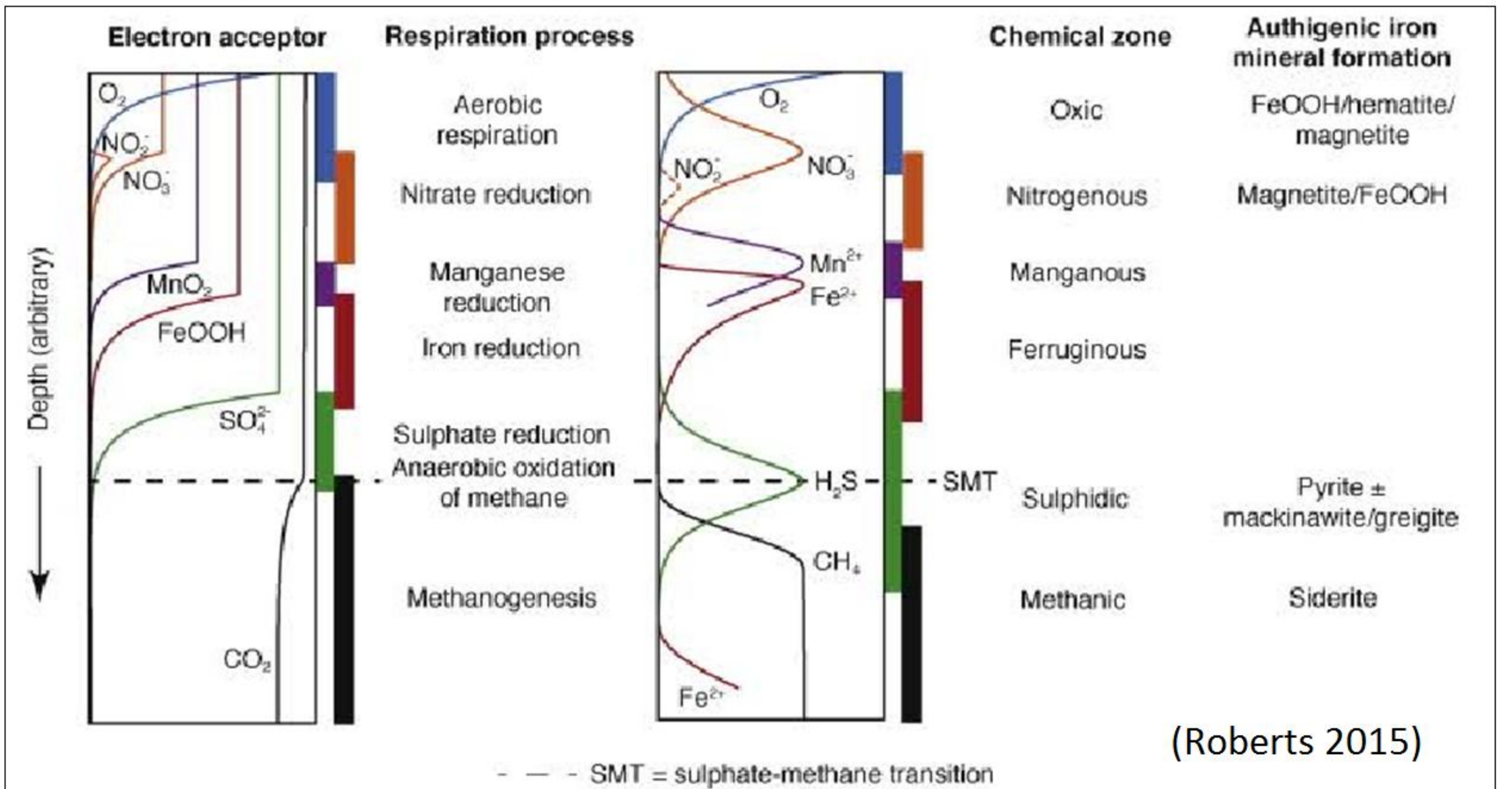
biogenic crystal production at the oxic anoxic interface (OAI)



Density of Greigite ;
as specific gravity = 4
metastable

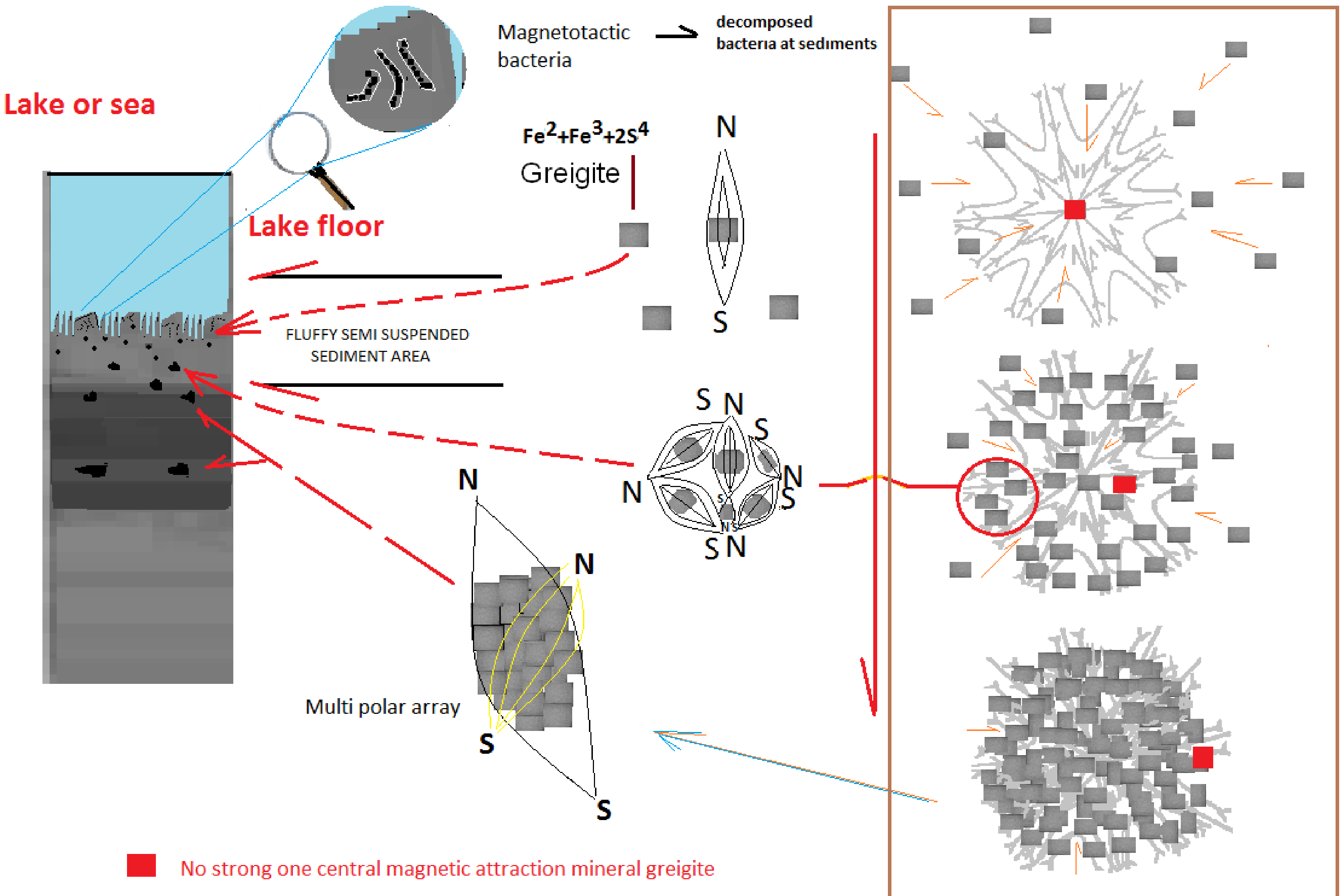




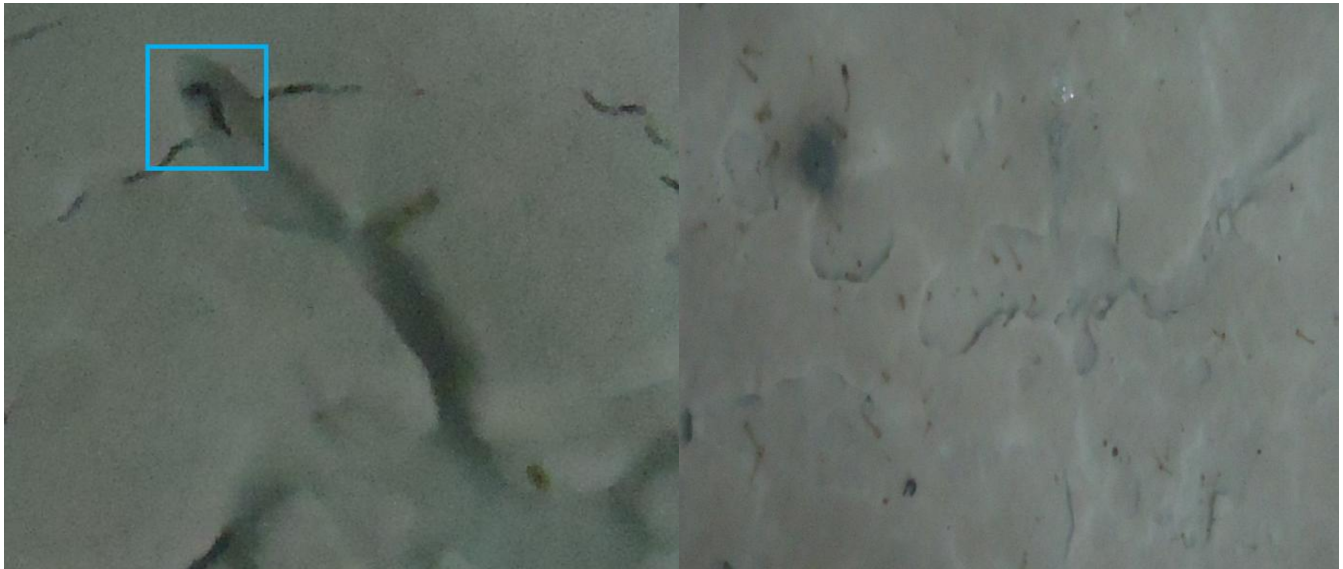


(Roberts 2015)

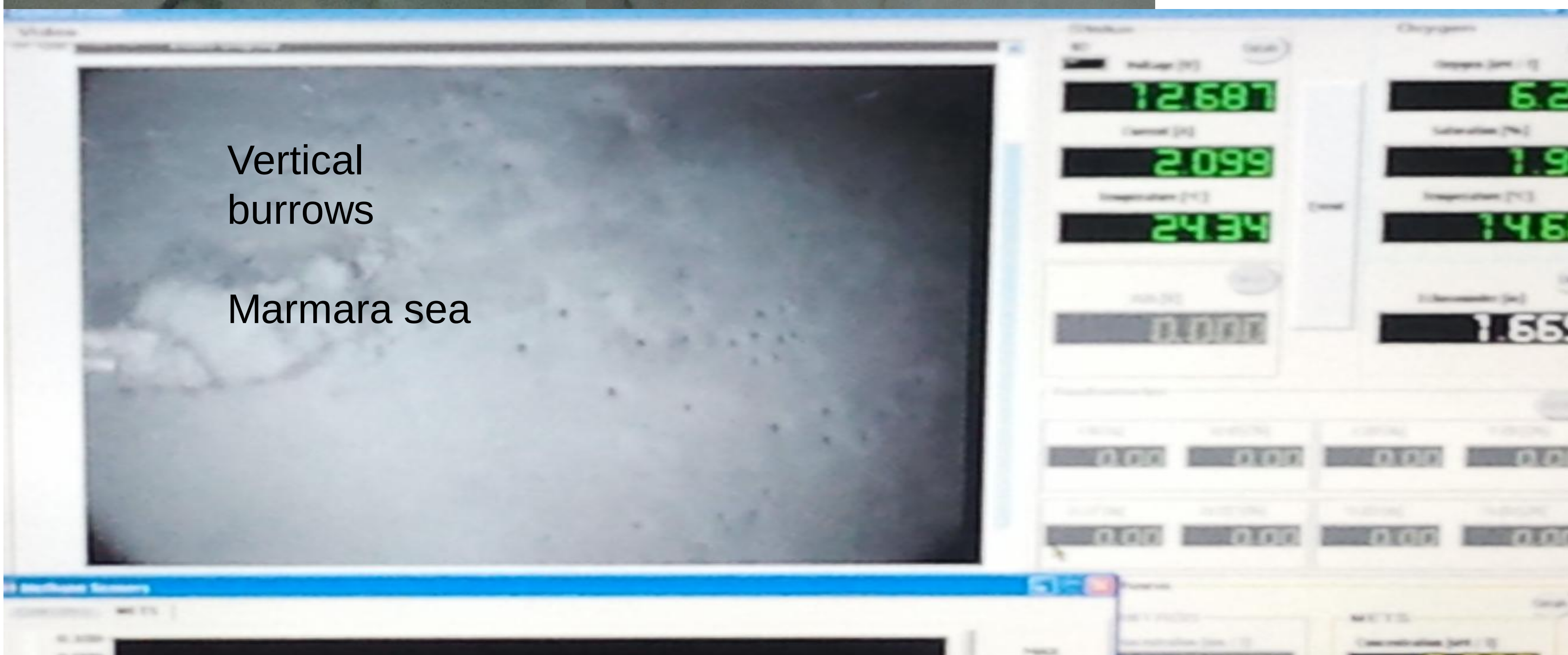
Greigite mineral particles as shrinking and condensing cloud in sediment by diffusion type movement



Burrow canals



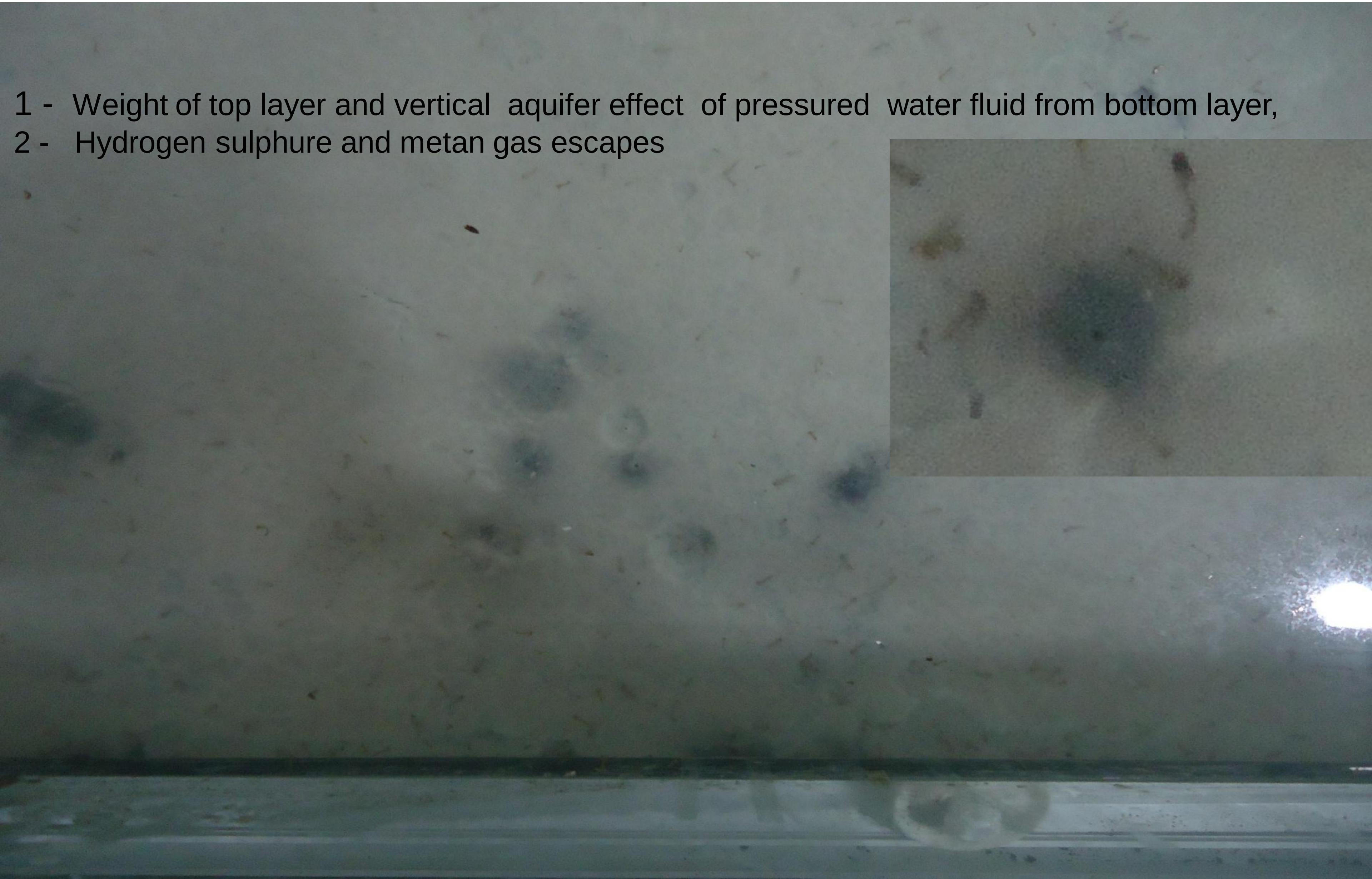
- Horizontal burrows



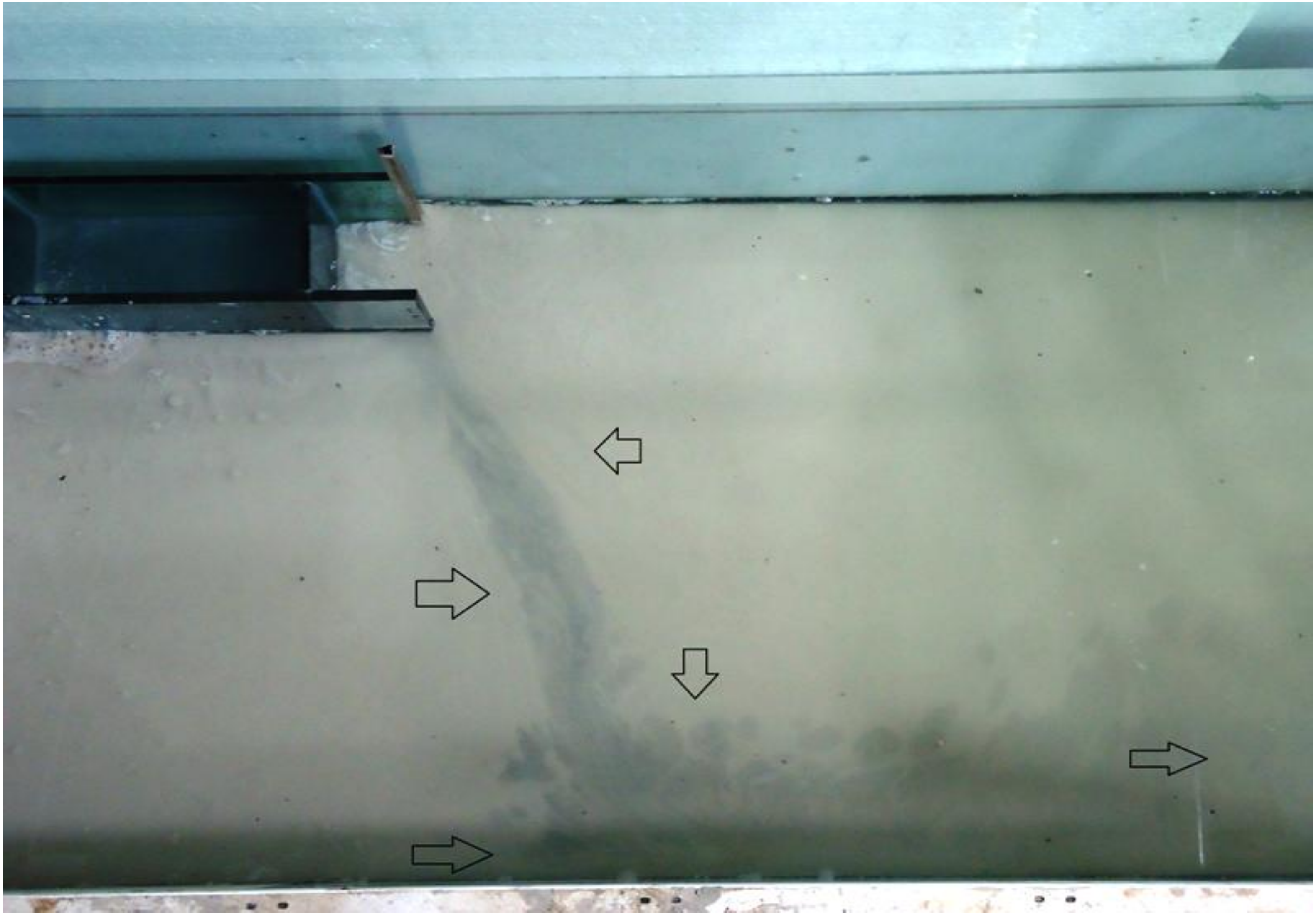
Vertical flows and pockmarks

1 - Weight of top layer and vertical aquifer effect of pressured water fluid from bottom layer,

2 - Hydrogen sulphure and metan gas escapes



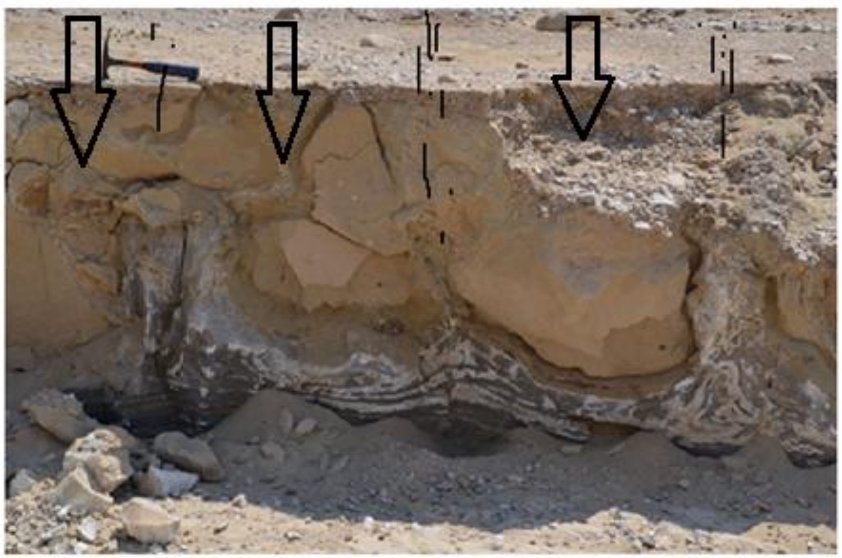
horizontal flows and dark patches

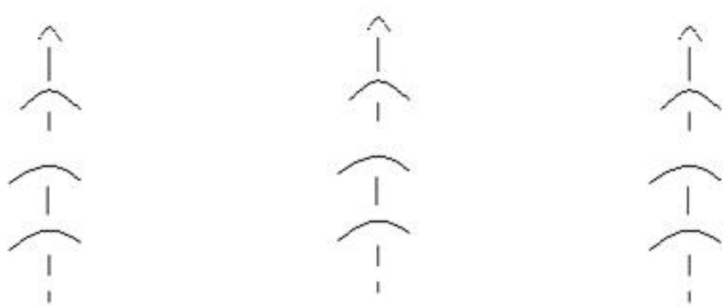


Tectonics

Liquefaction and vertical currents at front of P-wave nodes

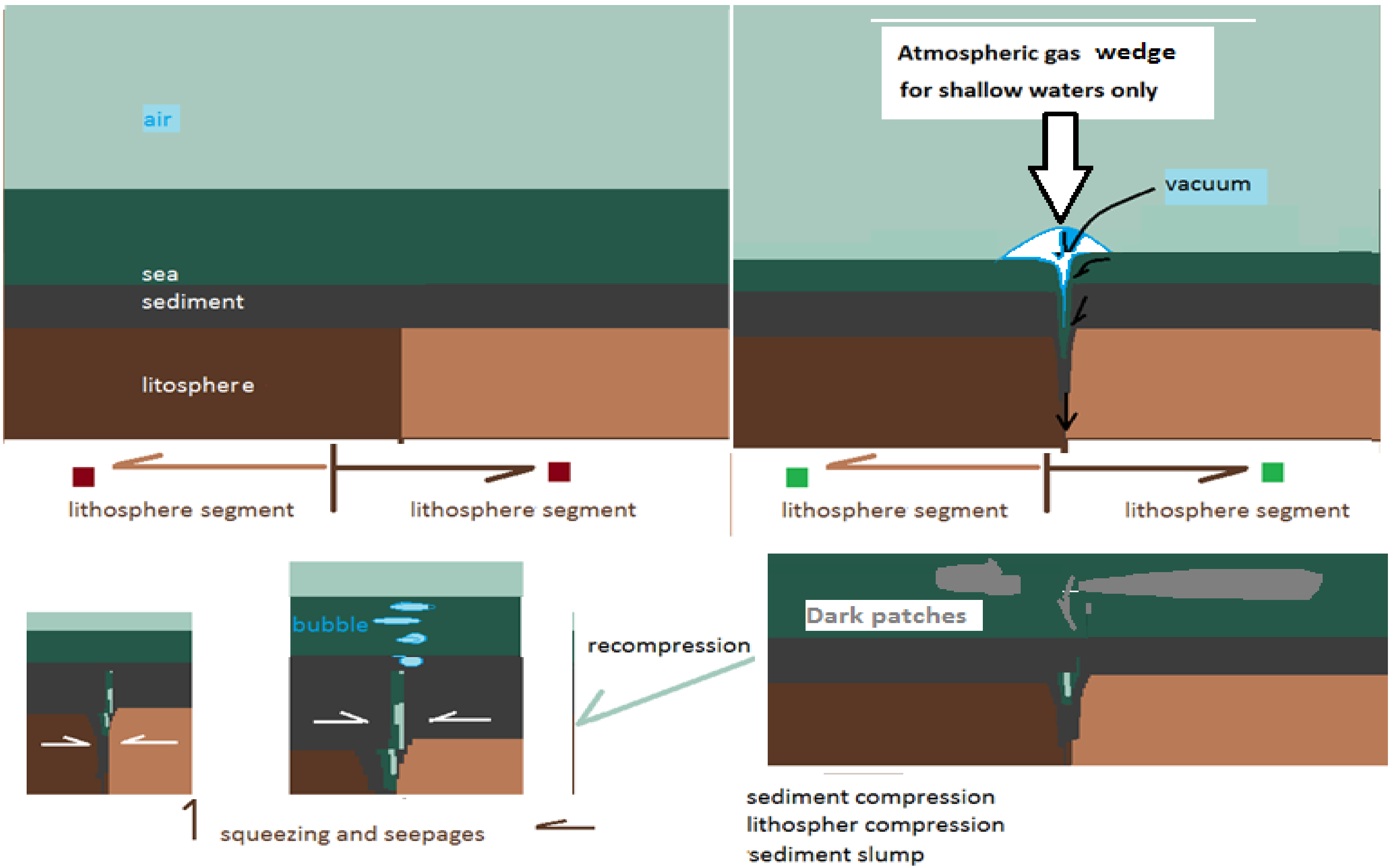
collapsing sediment blocks during bottom sediment liquefaction and liquid escapes of same bottom layer



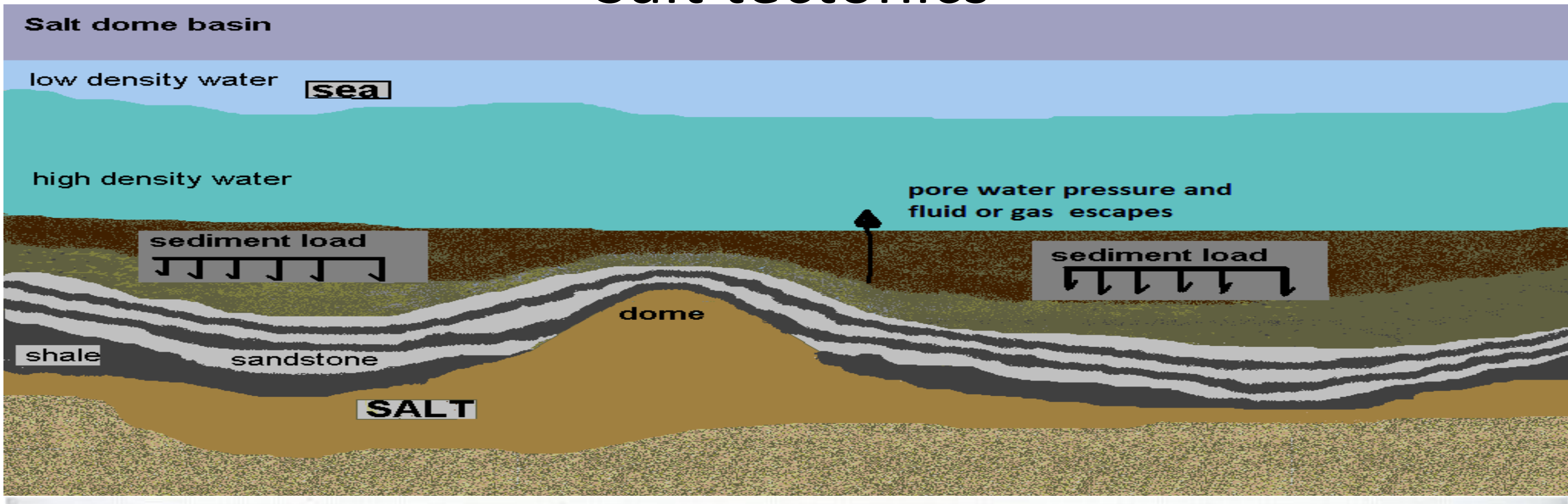


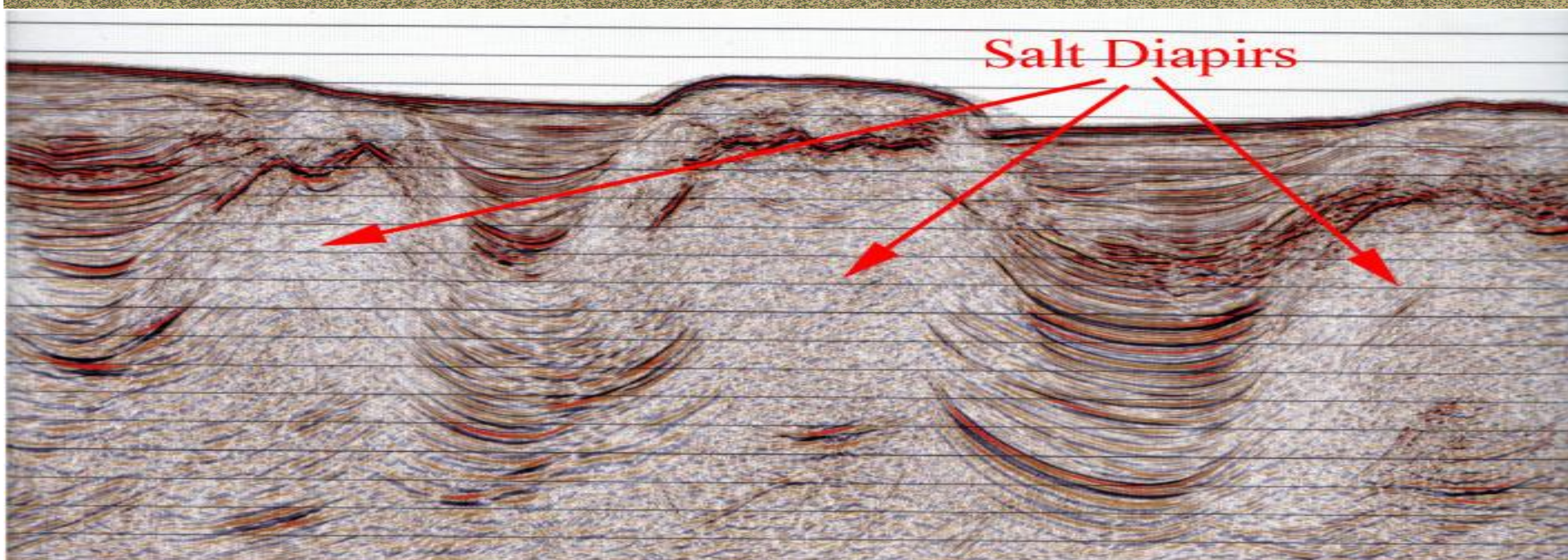
Pulse deformation and fluid escape
Considering anoxic sediment spray

Opening or compressing fault surfaces



Salt tectonics





- Brazil-Margin-Salt_editedSeismic image showing salt diapirs on the Brazil margin. Image courtesy of Peter Clift.

resources

- M. HOVLAND , J. V. GARDNER AND A. G. JUDD The significance of pockmarks to understanding fluid flow processes and geohazards Geofluids (2002) 2, 127–136
- Brazil-Margin-Salt_editedSeismic image showing salt diapirs on the Brazil margin. Image courtesy of Peter Clift.