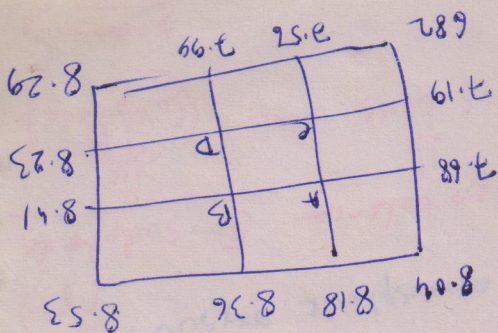


# Three mechanism for releasing groundwater

- ① Reductive dissolution of FeOOH and release of sorbed arsenic to groundwater

- ② Oxidation of arsenical pyrite

- ③ Anion exchange of sorbed arsenic with phosphate from fertilizer





of sulfur amounts to 200 mg/kg  
 ① Redox potential of 0.04 and 0.08  
 ② Redox potential of 0.04 and 0.08

## ① Oxidation of Pyrite

Favor

② Trace amount of pyrite is found in sediments.

Against

③ Sulfur concentration in aquifer sediments represent both pyrite and organic sulfur. Presence of pyrite shows it has not been oxidised and it is a sink.

When pyrite to be oxidised its arsenic would be sorbed to the resulting  $Fe(OH)_3$ , rather than be released to groundwater.

In anoxic groundwater Fe: sulfate molar ratio 0.5 were pyrite oxidation releasing arsenic.

Arsenic pollution is uncommon in hand-dug wells which are shallowest and most exposed to the atmospheric oxygen.

① Mass balance  
 from total  
 Sulfur sediment

② Mass balance

↓  
 Sulfate water

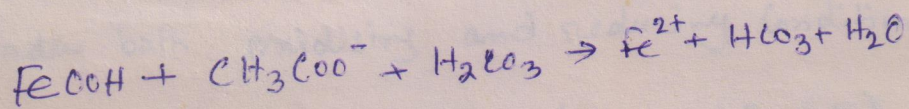
③ Sulphide (52)  
~~(Sulphate)~~  
Reducing



① Process involving of biogenic As forming in  
years

① Origin of biogenic

Reduction of  $FeOOH$  - has been invoked  
 to explain the presence of arsenic in anoxic  
 surface waters and anoxic groundwater.



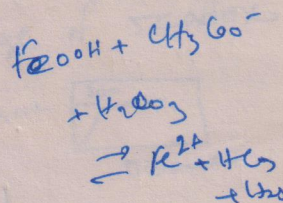
Reduction is driven by microbial metabolism  
 of organic matter.

Factors

① High concentration of  $Fe$  have been  
 reported.

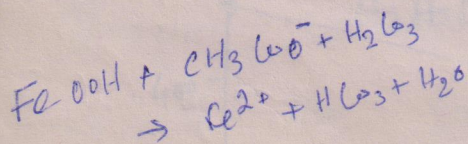
②  $Fe^{+2} \rightarrow$  high As

$Eh \rightarrow$  reducing  
 $+ 200 mV$



Excess use of fertilizer

fertilizer phosphate may compete with  
 As in aquifer. phosphate high groundwater  
 also contains As.



$Eh =$  Activity of  
 Electron

size  $As(OH)_3 \equiv (PO_4)$  So competition



## ① As in heavy metaloids

② mobility both in pH - 6.5 to 8.5 and under both oxidising and reducing condition.

③ Several oxidation state (-3, 0, +3, +5)

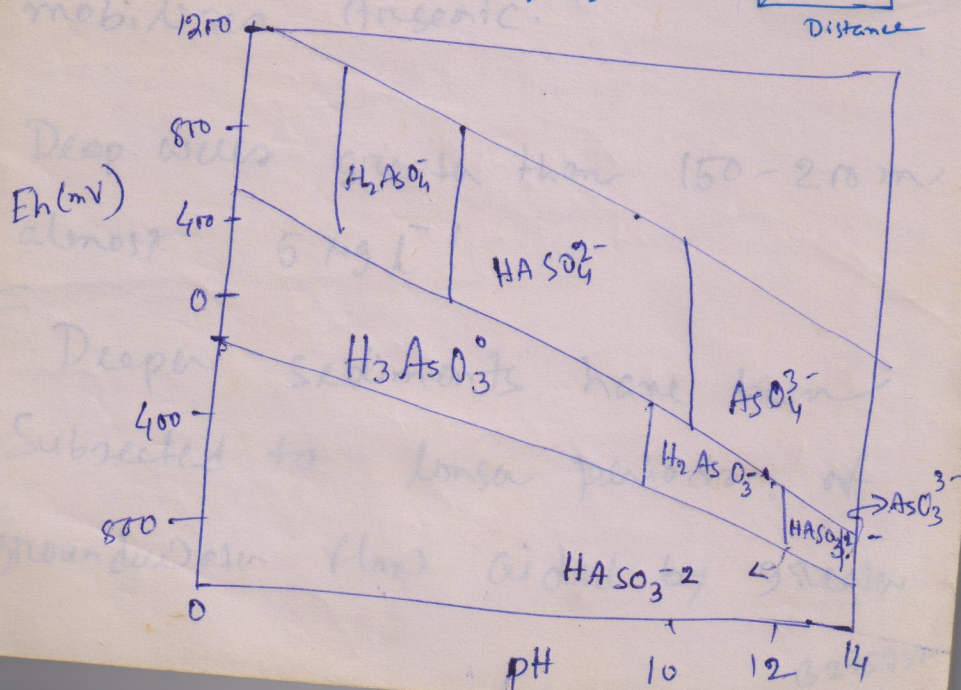
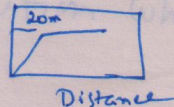
In natural water mostly as

trivalent Arsenite ( $\text{As(III)}$ )

Pentavalent Arsenate ( $\text{As(V)}$ )

Mobility over a wide range of redox condition.

$$H = \frac{S}{2} \sqrt{\frac{v_2 - v_1}{v_2 + v_1}} \text{ time}$$





and the presence of organic matter  
in the aquifer is a factor in the  
reduction of iron and manganese  
in the aquifer.

Aquifers are generally shallow less  
than 100-150 m deep of Holocene  
age.

In most affected area, aquifer are  
capped by a layer of clay or silt  
which restricts entry of air to the  
aquifers. This together with the presence  
of recent solid organic matter  
resulted in reducing condition which  
mobilizes Arsenic.

Deep wells greater than 150-200 m  
almost  $5 \text{ mg l}^{-1}$

= Deeper sediments have been  
subjected to longer periods of  
groundwater flow aided by greater

B275732



from 120-125 m grab of Hagarani  
Hydrate on basement exposures note

hydraulic heads during Pleistocene  
when glacial sea levels around the  
Bangladesh were up to 130m lower than  
today.

$$\delta O_2 = \left( \frac{(R_2)_s}{(R_2)_{sw}} - 1 \right) \times 1000$$

$$\left( \frac{\delta O_2}{1000} + 1 \right) (R_2)_{sw} = (R_2)_s$$

$$\left( \frac{\delta O_2 + 1000}{1000} \right) (R_2)_{sw} = (R_2)_s$$

$$\left( \frac{\delta O_2 + 1000}{1000} \right) (R_2)_{sw} = (R_2)_s$$