



Importance of the Site Investigation for Development of Methane Hydrate

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My Background

- Civil Engineer
- Site Investigation
 - Soil Parameters for Design
 - Very Soft Clay and Loose Sand
- Mining VS Civil Engineering

Difference in the ground condition for usual mining

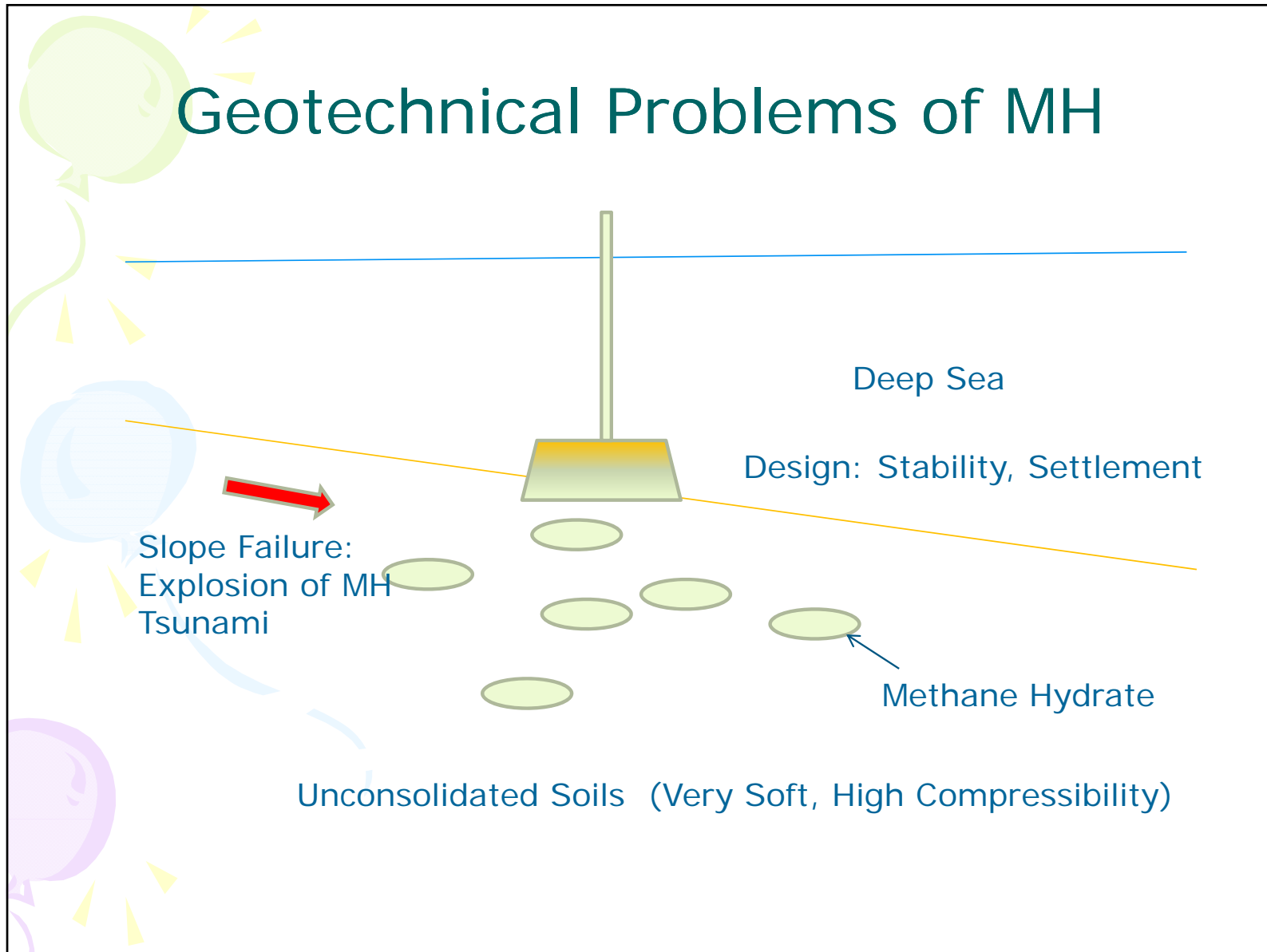
- Usual mining
 - Rock (Consolidated)
- Methane Hydrate
 - Unconsolidated material
 - Deep sea

Open Cut Mining Hard Rock



Oilrig Deep Sea, Foundation







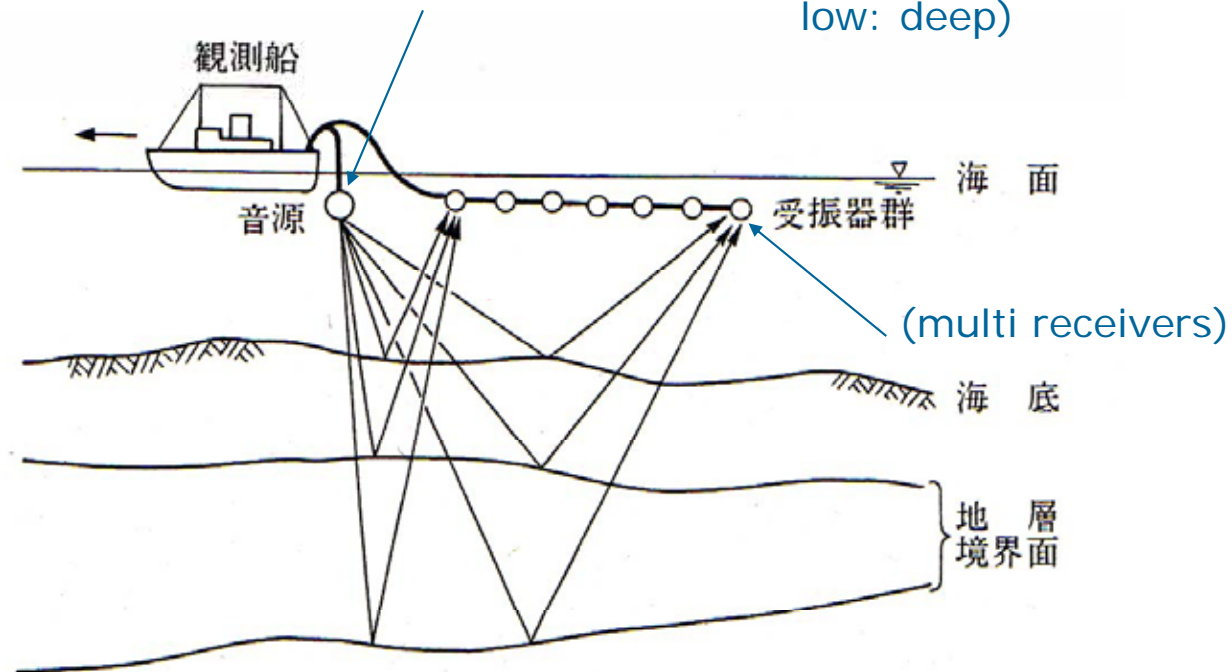
How to obtain design parameters

- In Situ Testing (Sounding)
 - Physical Methods (Acoustic)
 - Dynamic Penetration (SPT)
 - Static Penetration (CPT)
 - Vane Testing
- Laboratory Testing
 - Sampling

Acoustics Method (Ocean)

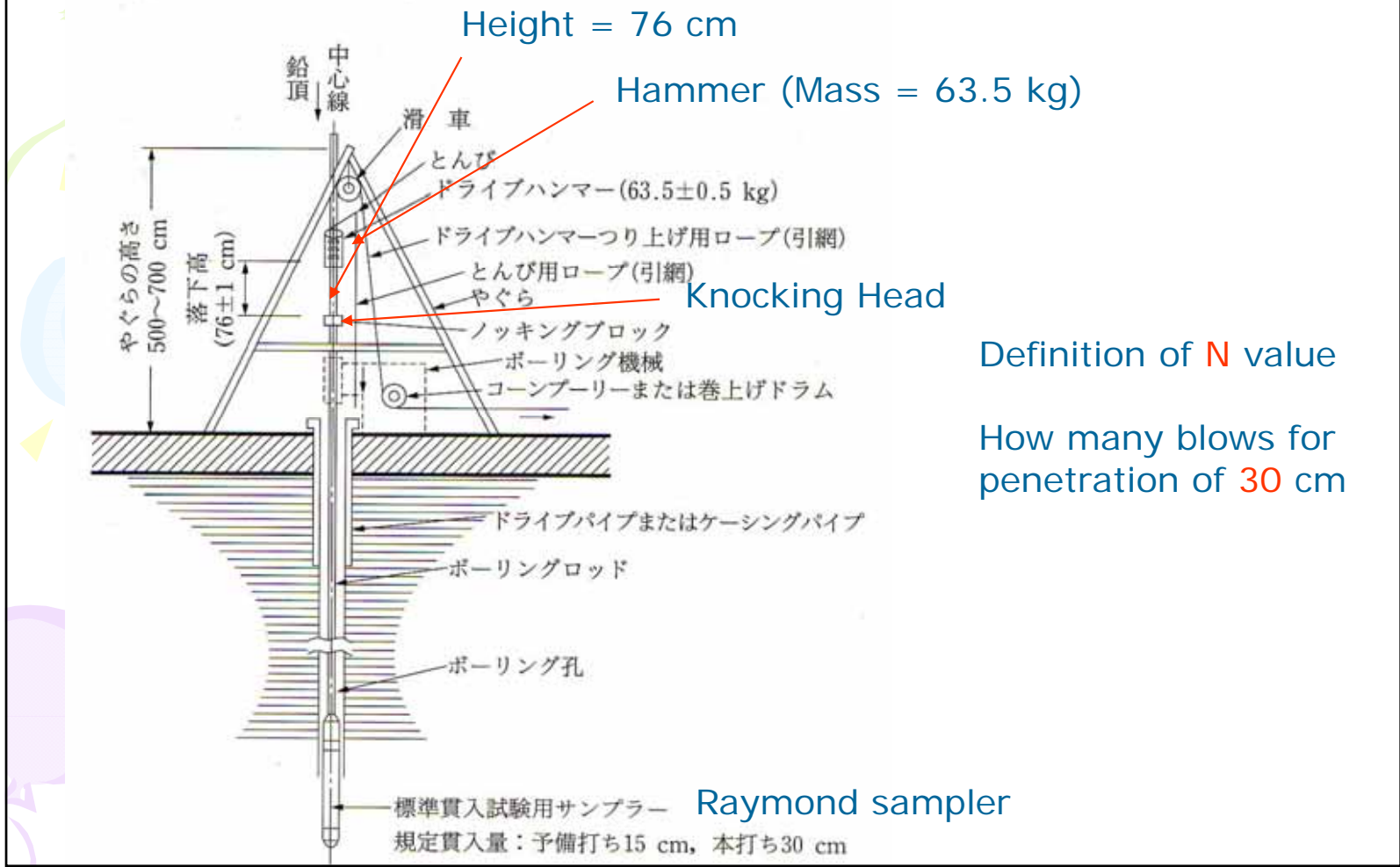
Developed for Oil Exploration

Source (Frequency high: accurate, shallow
low: deep)



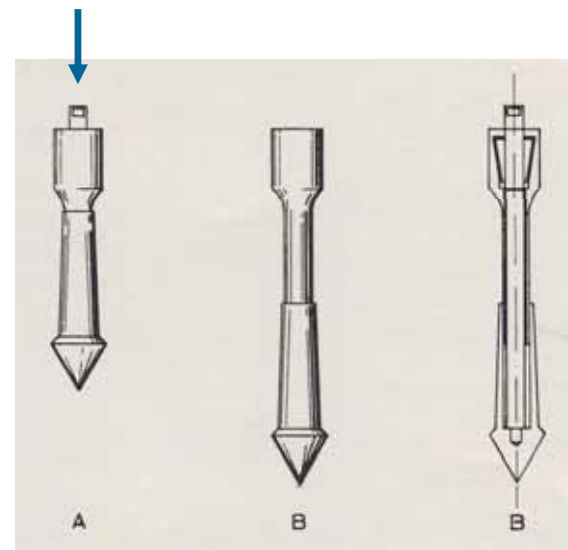
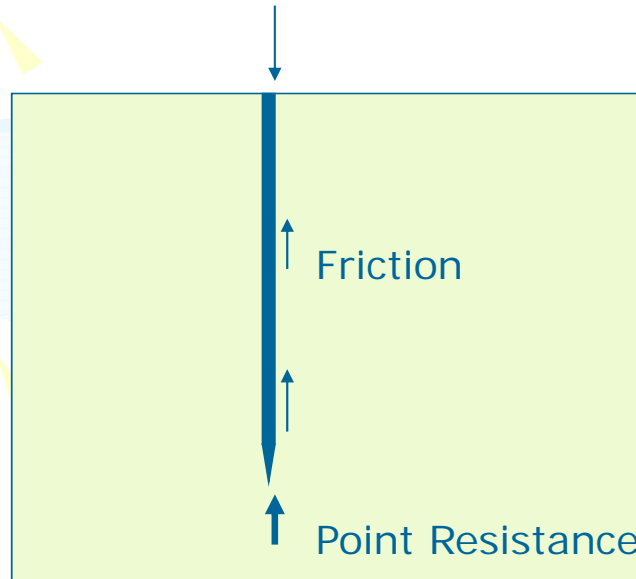
Recently, this method is widely used to detect active faults.

Standard Penetration Test (SPT)

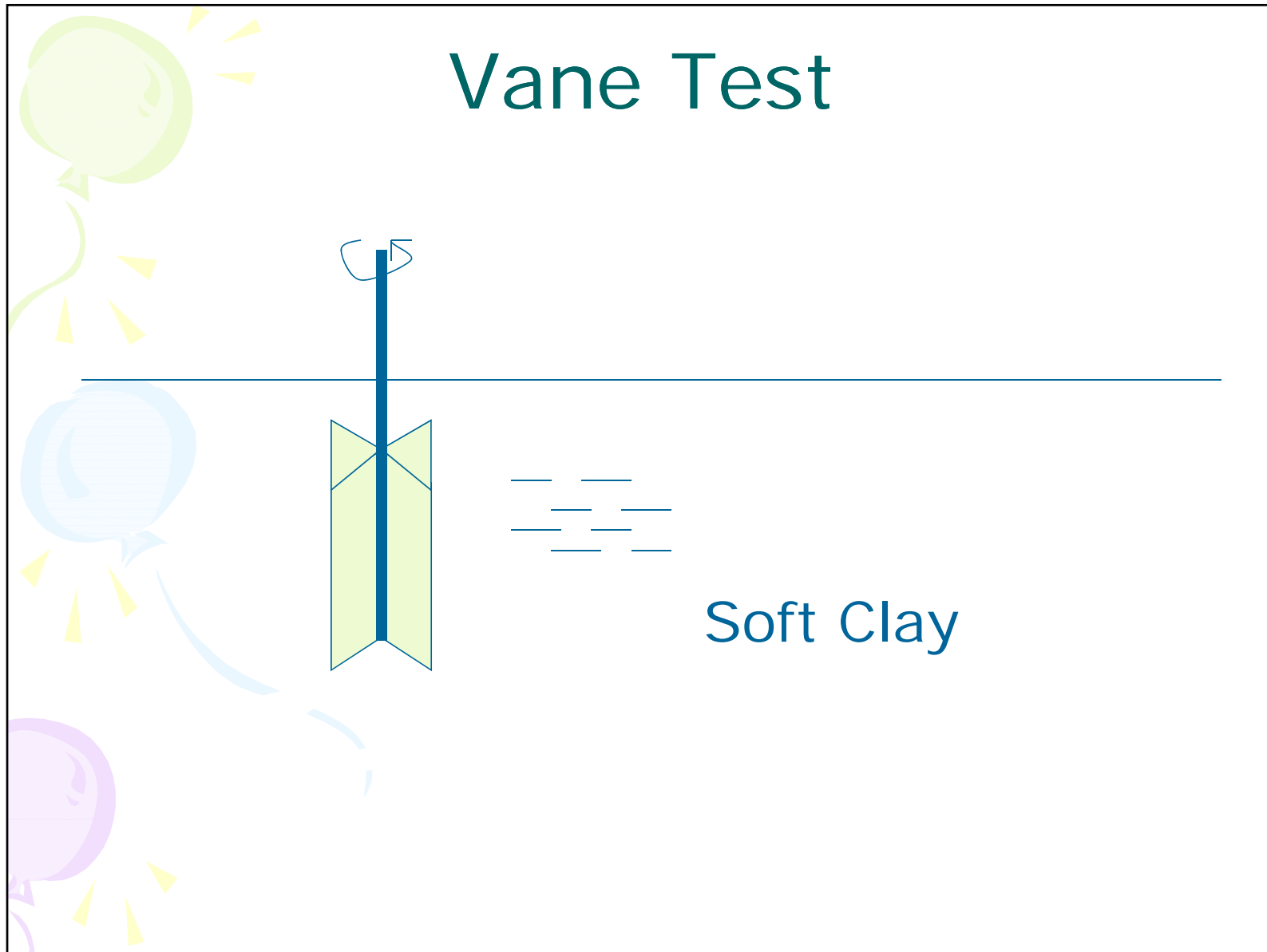


Static Cone Penetration

Measurement of penetration force



Development of Dutch Cone



Sampling in the Lake Baikal

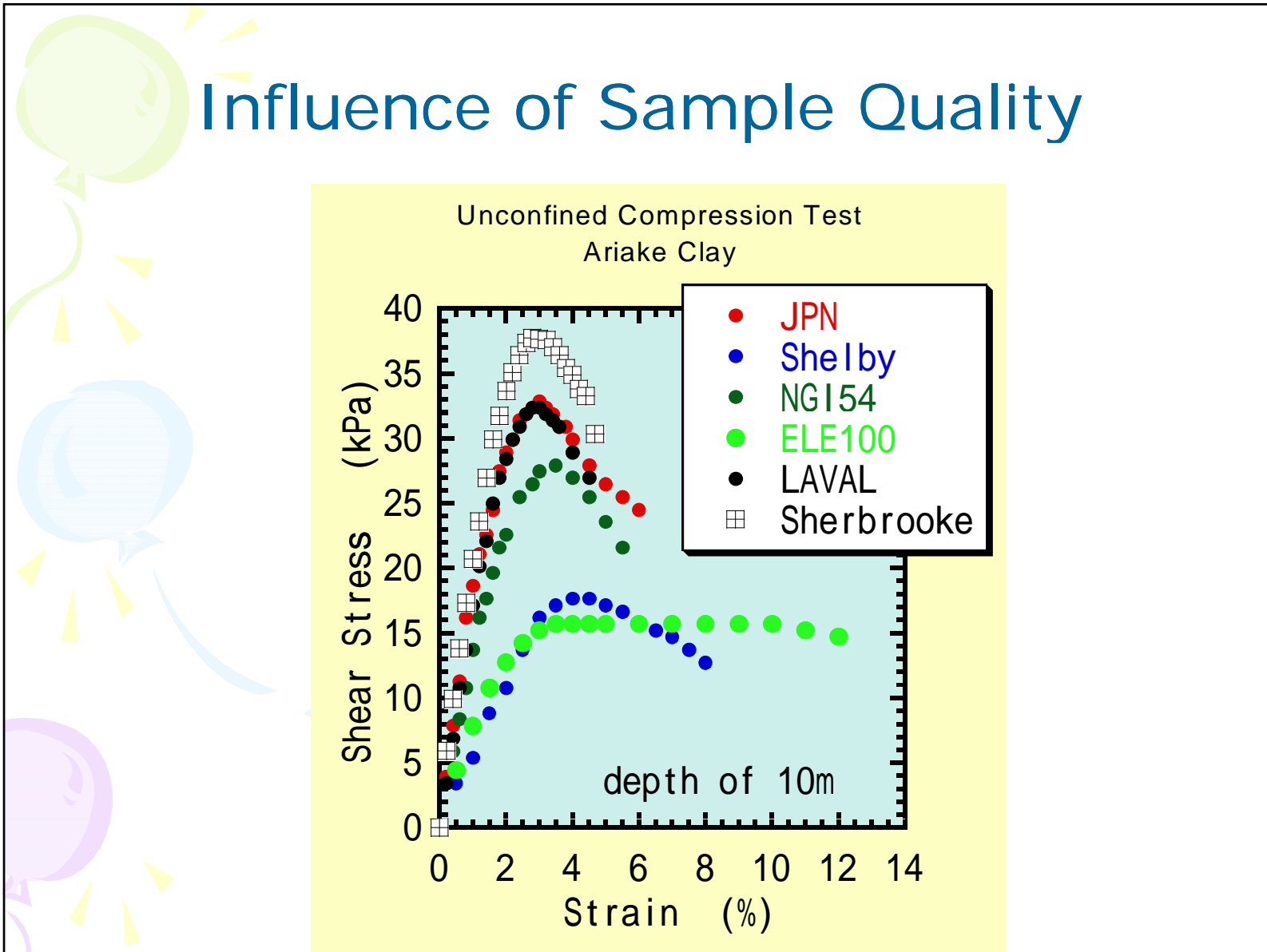
Gravity Core









CPT

Memory Cone: No cable





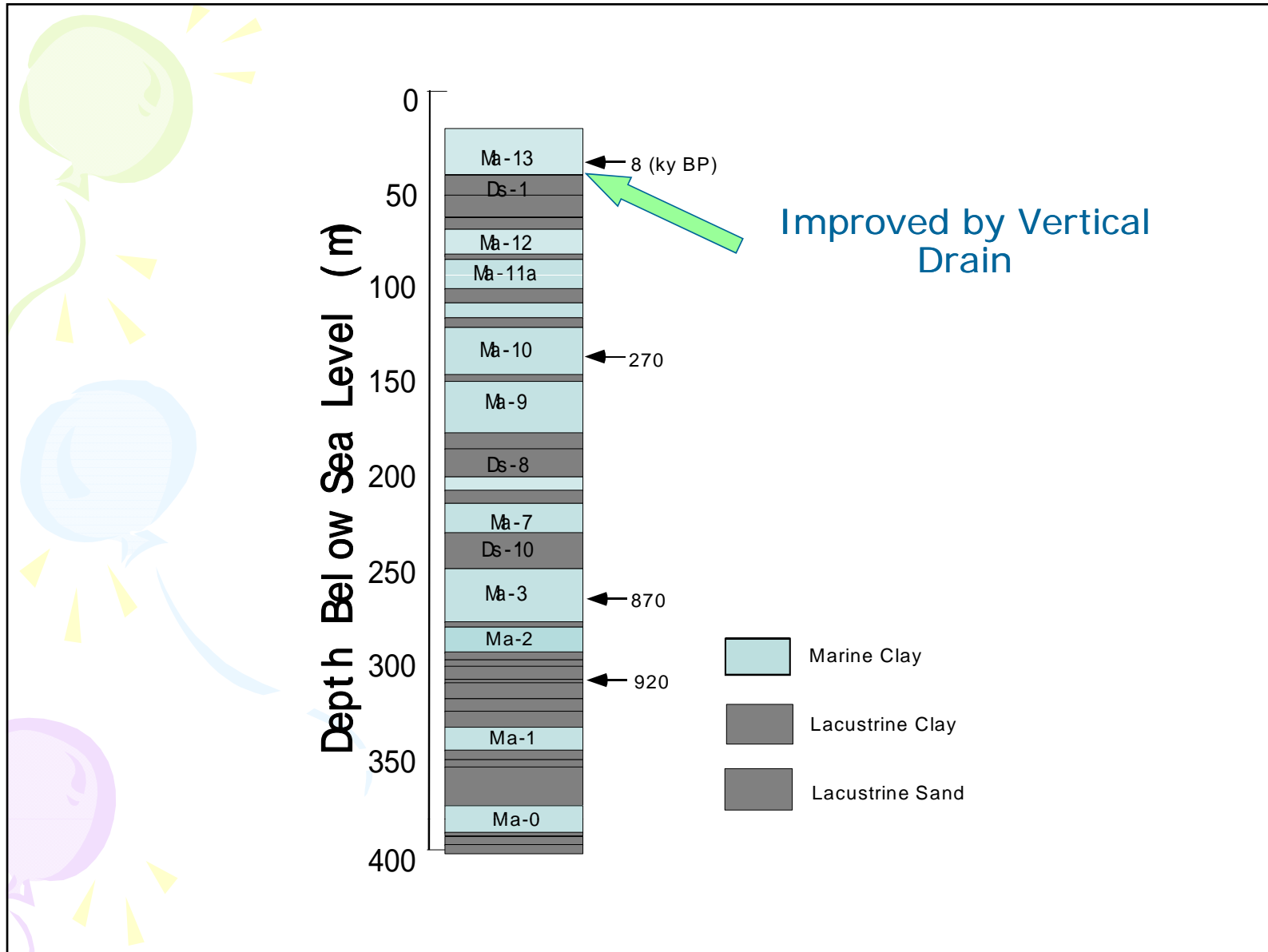
Samplers used at the site

Sampler	Nation		Inside Dia. (mm)	Sampler Lengt (mm)	Thickness (mm)	Area Ratio (%)	Piston	Remarks
JPN	Japan		75	1000	1.50	7.5	Yes	PreBore
Shelby	US		72	610	1.65	8.6	No	PreBore
NGI54	Norway		54	768	13.00	54.4	Yes	Dis. Composit
ELE100	UK		101	500	1.70	6.4	Yes	Semi-Dis.
Laval	Canad		208	660	4.00	7.3	No	Over-Corin
Sherbrooke	Canad		350*	250*	-	-	No	No Tube

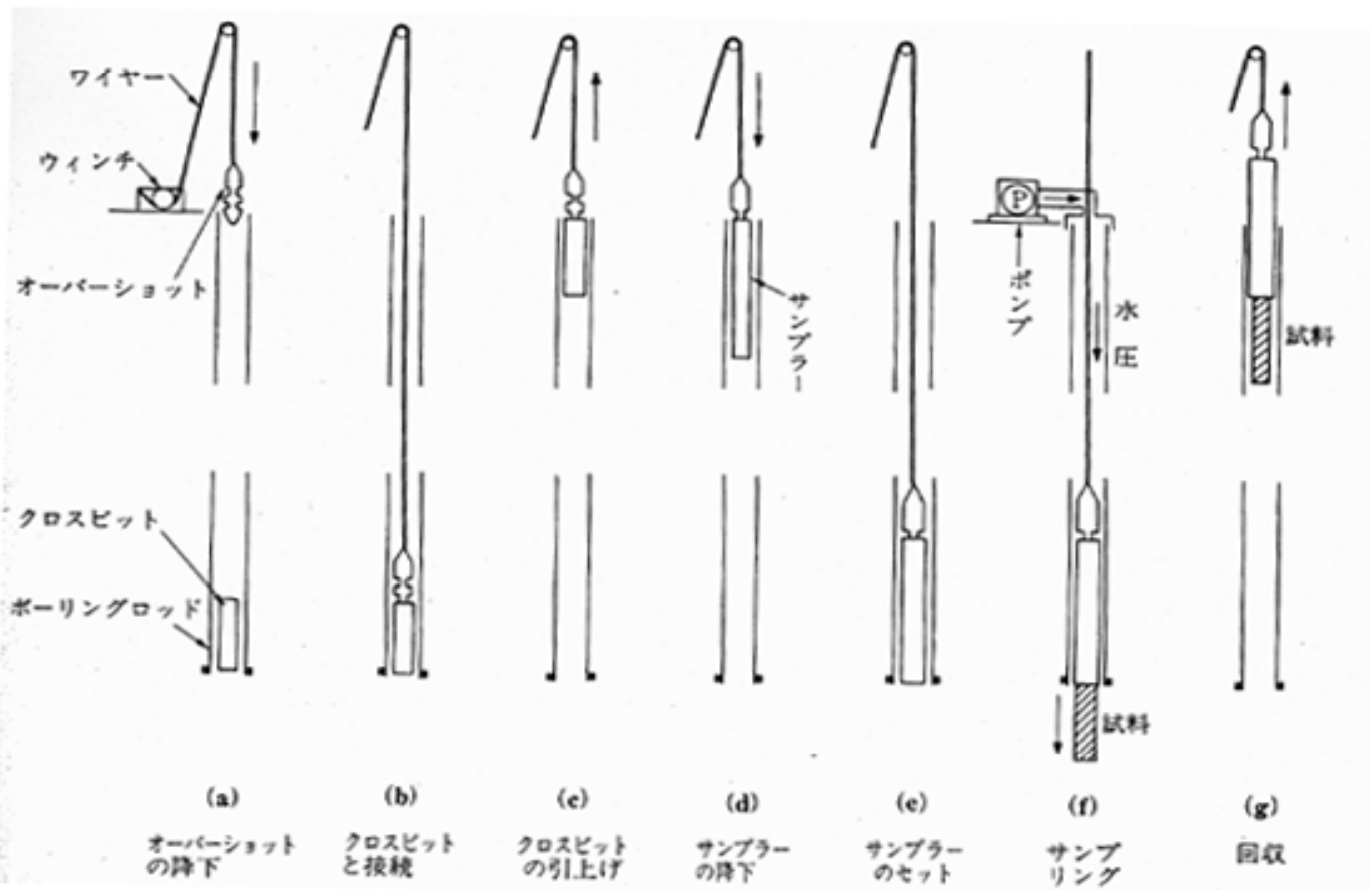
Size of sample

Kansai International Airport





Sampling Procedure (Wire-Line)



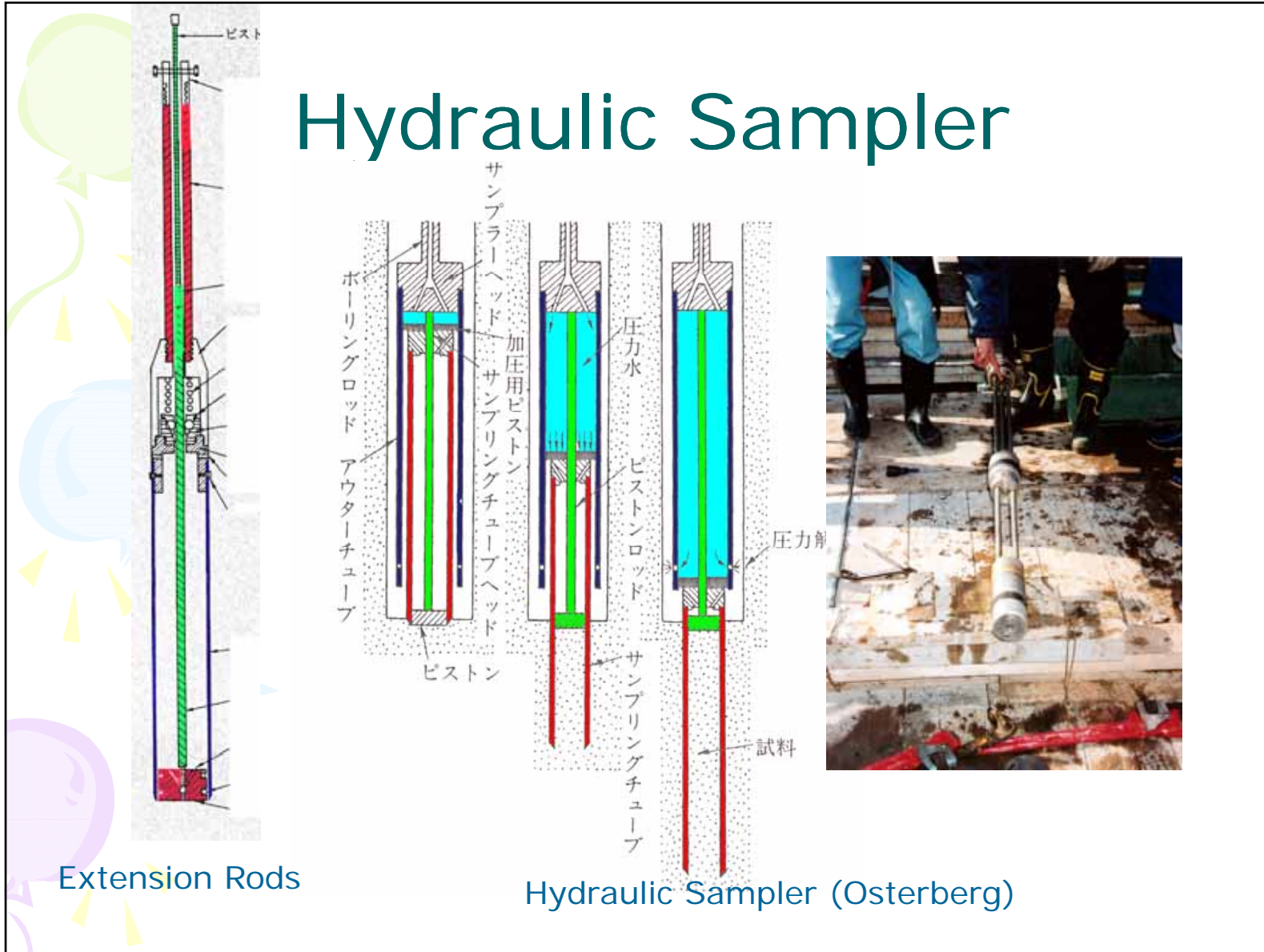


Wire-Line method



The stage for sampling

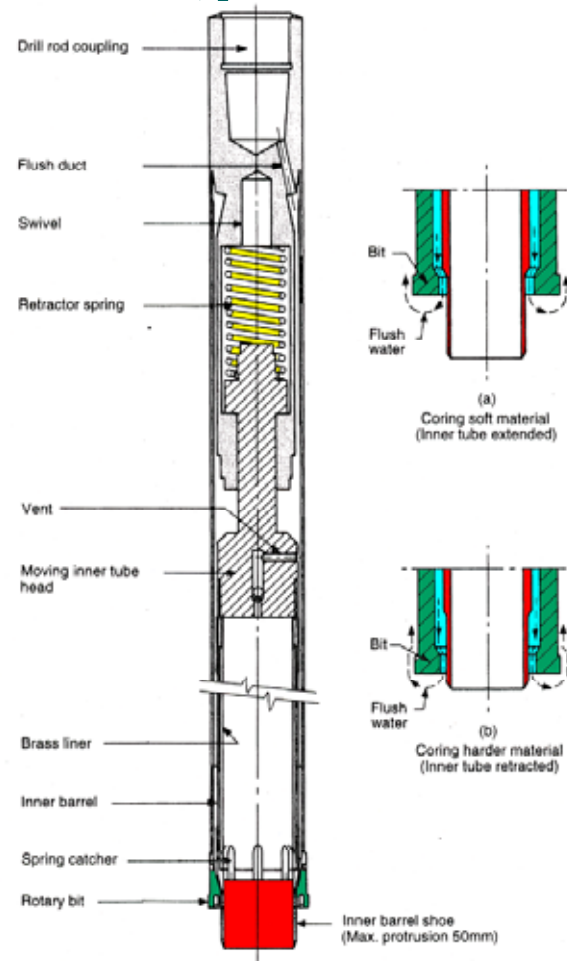
Hydraulic Sampler



Extension Rods

Hydraulic Sampler (Osterberg)

Rotary core sampler





Summaries

- Precise soil parameters required for MH development
- Deep Sea water
- Development of CPT and Samplers