Roy, S.L., Saha, K.C., Roy, S., Kabir, S., Quamruzzaman, Q. and Chakraborti, D. (1999) Arsenic poisoning in the Ganges delta. Nature, v.401, pp.545-546.

Fisher, Q.J., Raiswell, R. and Marshall, J.D. (1998) Siderite concretions from nonmarine shales (Westphalian A) of the Pennines, England: Controls on their growth and composition. Jour. Sed. Res., v.68(5), pp.1034-1045.

Fuller, C.C., Davis, J.A. and Glenn, A.W. (1993) Surface chemistry of ferrihydrite, Part - 2, Kinetics of arsenate adsorption and co-precipitation. Geochim. Cosmochim. Acta. v.57, pp.2271-2282.

Mallick,. S. and Rajagopal, N.R. (1996) Groundwater development in the arsenic- affected alluvial belt of West Bengal - some questions. Current Science, v.70(ii), pp.956-958.

McArthur, J.M., Ravenscroft, P., Safiulla, S. and Thirlwall, M.F. (2001) Arsenic in groundwater: Testing pollution mechanisms for sedimentary aquifers in Bangladesh. Water Resources Research, v.37, no.1, pp.109-117.

Nickson, R., Mc.Arthur, J., Burgese, W., Ahmed, K. M., Raveriscroft, P. and Rahman, M. (1998) Arsenic poisoning of Bangladesh groundwater. Nature, v.395, p.338.

Nickson, R.T., McArthur, J.M., Ravenscroft, P., Burgess, W.G., and Ahmed, K.M. (2000) Mechanism of arsenic release to groundwater, Bangladesh and West Bengal. Applied Geochemistry, v.15, pp.403-413.

AN INDIGENOUS APPROACH TO LOW COST PORTABLE VIBRACORING IN DELTAIC ENVIRONMENTS

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Abstract: A simple but very effective and inexpensive indigenous method of vibracoring has been developed for acquisition of continuous cores in subaqueous environments at water depths of below 2m. The principal components are the following: 3.5 HP concrete vibrator, irrigation PVC tube, tripod and pulley. The entire system weighs 50 kg. and approximately costs about Rs.25,000/-. This system was operated successfully in the transitional sedimentary environments of the East Coast deltas by collecting around 100 cores averaging to 2 m in length. Sediments ranging from clay to coarse sand have been recovered using this system. Percentage of recovery was usually 60 to 100 and distortion of delicate sedimentary structures was generally minor.

Keywords: Vibracoring, Deltaic environments, Andhra Pradesh.

INTRODUCTION

Vibracoring has to a large degree solved the problem of collection of cores of unconsolidated sandy or compacted sediments in deltaic environments (Sanders and Imbrie, 1963; Ginsburg and Lloyd, 1956). However, most of the existing vibracore systems are designed for shipboard and land use, but are too large to be used on small boats in shallow water environments (Stone and Morgan, 1992). Therefore, for facilitating core sampling in both coastal and shallow water environments, a portable vibracore system has been developed by us. The entire system is relatively light in weight requiring only 2 to 3 persons for operation. The system can also be transported in small boats to remote locations.

UNIT COMPONENTS

The essential components are gasoline-powered concrete vibrator and PVC irrigation tubing as items of stock, besides the other fabricated items.

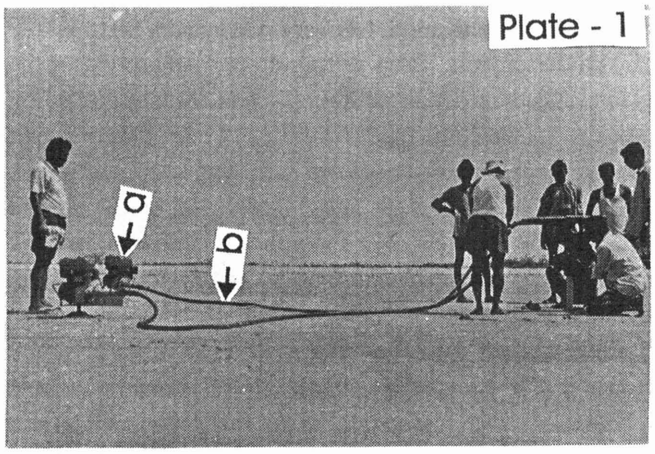
Vibrator: The vibrator needle is a commercially manufactured concrete vibrator powered by 3.5 HP gasoline engine (Plate 1a). The engine powers the cylindrical vibrating head internally through a flexible cable 3.8 cm in diameter. These cables come in lengths of 4 to 6m (Plate 1b).

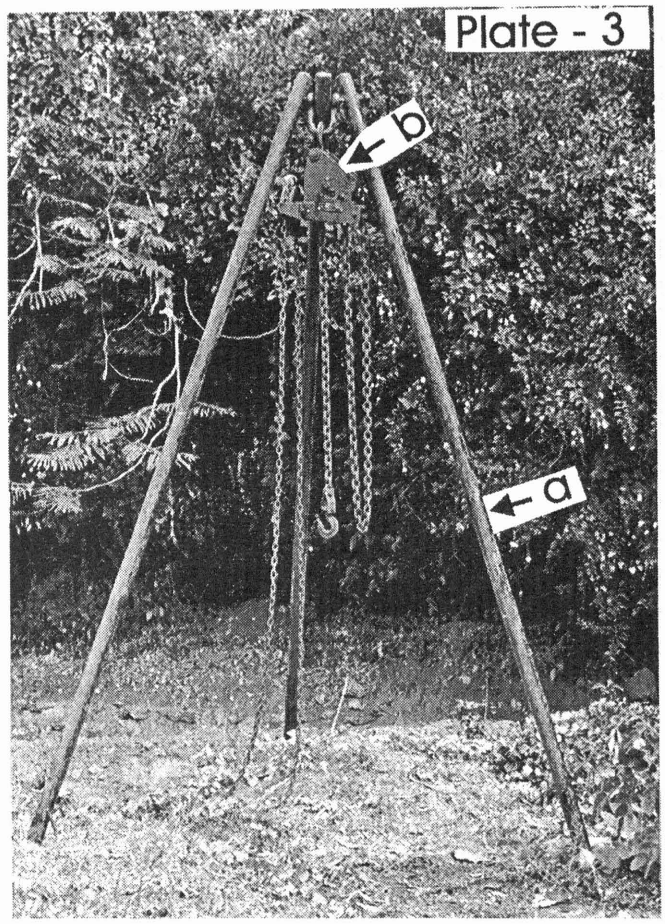
Clamp: The clamp is made of steel strips that are welded together in opposition and are bolted to the vibrating needle and core tube. The clamp remains bolted to the vibrating needle at all times and is bolted to the core tube only during coring (Plate 2).

Core Tube: A 6 m long standard 63mm PVC pipe (Plate 2b).

Tripod: A simple tripod to support the pulley (Plate 3a)

Pulley: A winch with an endless chain hoist to withdraw the core tube from the substratum (Plate 3b).





OPERATION

Place the engine on the ground or on board a raft or boat. The vibrator can be used comfortably for sampling in water columns of different depths upto 2 m from the surface. Mount the vibrator needle on to the clamp tightly and fix it perpendicularly to the core tube (Plate 2). Then place one end of the PVC tube on the ground at the selected sampling spot holding the tube on either side of the clamp in vertical position. Now switch on the engine and the vibrator starts working. As the vibrator operates, it drives the PVC tube into the substratum of the environment. Then the clamp also moves nearer to the ground. Adjust the clamp upwards as required. After attaining the maximum penetration, the PVC tube stops going down. Then stop the engine. Move the clamp down up to the ground level. Examine the position of the core inside the tube from the top end. Cut off and remove the rest of the PVC tube approximately either at that point or above the clamp and instantly close the end with a suitable cap. The depth and duration of penetration of the PVC tube vary depending

Table 1. Details of the environments, average length, water depth and sediment type of Vibracores

Environment	Krishna delta	Godavari delta	Penner delta	Cauvery delta	Mahanadi delta	Average length	Water depth in metres	Sediment type
River channel	0	4	0	0	0	1.2	2	Coarse sand
Estuary	4	2	2	2	2	1.5	1	Fine sand/Clayey sand
Tidal creek	3	4	4	4	2	2.3	1.5	Clay
Mangrove swamp	3	4	3	3	3	2.4	0.5	Clay
Mud flat / tidal flat	3	4	4	4	4	2.5	0	Sandy clay/mud
Lagoon	4	2	2	1	2	2.1	1	Silty clay
River mouth bar	2	2	0	0	0	1.2	0	Medium sand
Spit	2	2	2	2	2	1.3	0	Medium sand
Beach	2	2	2	2	2	1.5	0	Medium sand

upon the sediment encountered. While the desired penetration is quickly attained in clayey sediments, longer time is taken to penetrate sandy sediments. If the depth of penetration of the PVC tube does not exceed 1m, generally no pulley is required to recover the tube. But in the instances of deeper penetration (>1 m), a tripod with pulley is required for easy recovery of the tube. In the case of penetration of about 1m, simply pull up the PVC tube holding the clamp with both the hands. In the case of penetration of >1 m, the tripod with pulley is moved to the installed on the spot to pull the tube up by tying the winch chain to the clamp. Once the bottom end of the PVC tube reaches the surface of the sediment, close that end also with a cap to prevent the core from sliding off due to gravity.

Approximately 100 cores averaging 2 m length up to a maximum length of 4 m were collected from deltaic environments, namely, river channel, estuary, mangrove swamp, tidal creek/channel, lagoon, tidal flat/mud flat, river mouth bar, spit and beach. Coring was done in the Mahanadi, Godavari, Krishna, Penner and Cauvery deltas (Table 1). Sediment types varied from clay and silt to very coarse sand with pebble sized and shell intraclasts. The penetration and the percentage of recovery related to the penetration are variable depending upon the local stratigraphy and sediment types. In coarse sands with intraclasts of large shells, recovery ranged from 60 to >90%. In homogeneous fine sand and sandy mud, recovery was usually 90 to 100%. The whole process, from setting up to dismantling of the system, takes one to three hours, while actual penetrating time to obtain a core ranges from 1 to 15 min. Distortion of delicate sedimentary structures was generally negligible. The entire system weighs approx. 50 kg and costs around Rs.25,000/-. In view of the simplicity in design, relative portability, ease in transportation, comfort in setting up, freedom in operation, cheapness in maintenance, this system is advantageous over the other systems that are currently available. The comparable efficiency in sampling, a reliable repeatability and low capital costs make this indigenous system a useful device for all workers concerned with various studies associated with sediments.

Acknowledgements: Support for the development and use of the vibracore system at the Department of Geology, Andhra University came from Indo-US Project sponsored by Smithsonian Institute. The authors thank Prof. P.Rajendra Prasad, Prof. A.S.R. Swamy and Prof. George F. Hart (Louisiana State University, USA) for their help in the development and use of the vibracore system. The authors are also thankful to Prof. A.S.R.Swamy, Coordinator, Delta Studies Institute, Andhra University, Visakhapatnam for permission to publish this article. Thanks are also due to Sri M.V.Rao, Research Officer, Institute of Wood Science and Technology, Visakhapatnam Centre, for his encouragement.

References

GINSBURG, R.N. and LLOYD, R.M. (1956) A manual piston coring device for use in shallow water. Jour. Sed. Petrology. v.26, pp.64-66.

SANDERS, J.E. and IMBRIE, J. (1963) Continuous cores of Bahamian calcareous sands made by vibradrilling. Geol. Soc. Amer. Bull., v.74. pp.1287-1292.

STONE, G.W. and MORGAN, J.P. (1992) Jack-up pontoon barge for vibracoring in shallow water. Jour. Sed. Petrol., v.4, pp.730-741.