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## Liquid-plastic Limit of Surface Sediments in North Slope of South China Sea

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### 1 Introduction

China has a vast area of continental shelf and is very rich in marine resources, but because of the complex geological environment and frequent geological disasters, the utilization of marine resources and the construction of marine engineering are limited (Zhu et al., 2016). As the implementation of offshore construction must rely on the seabed soil, so it's important to identify the type of sediments, the engineering geological conditions and other unstable factors. To this end, in-depth study of marine engineering geology is of urgent need, such as investigating the nature of the source bed sediment to provide guidance for the development of marine energy and engineering.

Liquid limit and plastic limit are important physical characteristics of seabed sediments, reflecting the impact of water on the nature of the soil in the sediment. As the water content will have an effect on the cohesion between the soil particles, the physical state of the sediments will change with the change of the water content (Peng et al., 2007). The liquid limit ( $w_L$ ) refers to the boundary water content when the transition from the plastic state to the flow state. The plastic limit ( $w_p$ ) is the boundary water content when the transition from the plastic state to the semi-solid state.

The determination of the liquid limit and the plastic limit can be used to determine the classification of soil. The soil state in the natural state can be determined according to the soil moisture content in the natural state, and the parameters can be used for the engineering application. For example, the plastic index ( $I_p$ ) can be used for soil engineering classification. The liquid index ( $I_L$ ) is also related to the bearing capacity of the soil (Shi

et al., 2001). Therefore, it is important to accurately determine the liquid limit and plastic limit of the sediments.

### 2 Study Area and Test Methods

#### 2.1 Study area

There are 14 stations in total and all the samples are collected from these stations shown in Fig. 1.

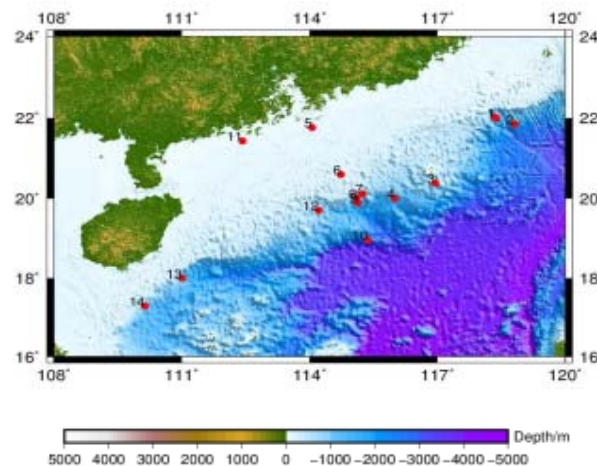


Fig. 1. Location of the Stations

#### 2.2 Test methods

The disc method and cone method are two methods in determining the liquid limit, and the domestic scholar more commonly use cone method, while rolling method is used in determine plastic limit. As specified in the Specification, the combined measurement of liquid and plastic limits can be used to acquire liquid and plastic limit. This method is not only simple and accurate, the standard is also easy to be united. In this paper, the experiment is carried out by the combined measurement

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of liquid and plastic limits, and the cone with the mass of 76g and the cone angle of 30 ° is used.

### 3 Test Results and Analysis

The latitude, longitude and water depth information of Box-type samples and Columnar-type samples are listed in Table 1.

**Table 1 Information of stations**

Station No.	Longitude(°)	Latitude(°)	Depth(m)
1	118.345	22.014	1500.00
2	118.806	21.846	1715.00
3	116.947	20.379	665.00
4	115.998	20.005	1212.00
5	114.059	21.763	39.26
6	114.735	20.599	107.61
7	115.243	20.115	636.00
8	115.101	20.000	1062.28
9	115.134	19.890	1390.00
10	115.367	18.959	2398.00
11	112.423	21.433	24.28
12	114.209	19.703	626.55
13	111.007	17.993	1493.00
14	110.133	17.283	1108.00

**Table 2 Test results**

Stations	Liquid Limit(%)	Plastic Limit(%)	Plastic index(%)	Classification
1-1	64.7	27.6	37.0	CH
1-2	59.2	30.3	28.9	CH
2-1	74.9	38.7	36.2	MH
2-2	68.0	35.7	32.3	MH
3	87.2	47.0	40.2	MH
4-1	112.1	57.6	54.4	MH
4-2	76.5	48.4	28.1	MH
5	70.1	30.7	39.4	CH
6	30.6	19.3	11.3	CI
8	103.0	40.3	62.7	CH
9-1	105.8	50.9	54.9	MH
9-2	123.6	46.9	76.8	CH
10	75.1	56.8	18.3	MH
11	59.9	27.8	32.1	CH
12	74.4	32.0	42.4	CH

Note: CH is referring to High Liquid Limit Clay, while MH is referring to High Liquid Limit Silt, and CI is referring to Intermediate Liquid Limit Clay.

The liquid limit, plastic limit can be acquired from experiments, and plastic index is calculated by these two parameters. And then the classification of soil can be

determined. The data results of all the Box-type sample collections are listed in Table 2. It can be seen from Table 2 that the continental soil types in the northern part of the South China Sea are mainly silty soil and clay soil; most soil are high liquid limit soil and their plasticity is strong.

As the Columnar-type sample collections need to be stratified for testing (depth of 0-20cm, 20-40cm, 40-60cm, 60-80cm), a picture of liquid and plastic limit changes with depth can be drawn (Fig. 2).

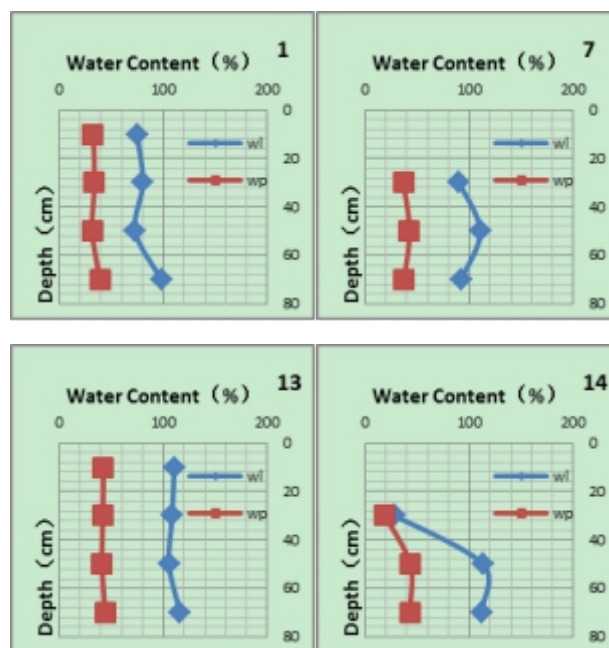


Fig. 2. Liquid and plastic limit changes with depth of 4 stations

### Acknowledgement

The sample collections used in this paper were supported by NSFC Open Research Cruise (Cruise No. NORC2015-05 and Cruise No. NORC2015-06), funded by Shiptime Sharing Project of NSFC. This cruise was conducted onboard R/V “SHIYAN 3” by South China Sea Institute of Oceanology, Chinese Academy of Sciences, and “DONGFANGHONG 2” by Ocean University of China.

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