Acta Oceanographica Taiwanica
No. 30, PP. 77-84, 6Figs., March, 1993

COMMENT ON "NAMING OF THE SUBMARINE CANYONS OFF NORTHEASTERN TAIWAN: A NOTE" BY HO-SHING YU (1992)

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ABSTRACT

Based on the bathymetric data colleted in 1992 and 1993, the two prominent valley-like submarine features off the northeastern coast of Taiwan which were named by Yu (1992) "Chilung Canyon" and "Huapinghsu Canyon" should be renamed as "Chilung Valley" and "Mien-Hua Canyon", respectively.

INTRODUCTION

Yu (1992) have named two submarine canyons off northeastern Taiwan the Chilung Canyon and the Huapinghsu Canyon. His criteria for naming these two distinct linear depressions on the shelf and slope were based on published bathymetry not including new findings.

After a scrutiny of the bathymetric data collected in recent years (Song, 1992, 1993), a revision of some of the names proposed by Yu (1992) is necessary. For instance, the naming of "Chilung Canyon" by Yu is not suitable; we suggest that the name "Chilung Valley" seems more proper.

We follow the guidelines for naming or defining submarine features (Bouma, 1990). The "submarine canyon" is "a relative narrow, deep depression with steep sides, the bottom of which generally has a continuous slope, developed characteristically on some continental slopes". In other words, submarine canyon usually commences on the continental shelf, commonly at the mouth of large rivers, cutting to the base of continental slope and serving as a major conduit of detritus sediment from the continents to the deep basins (Kennett, 1982).

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DATA AND RESULTS

The bathymetry off the northeastern coast of Taiwan from 121 ° 40'E, 24 ° 55'N to 122 ° 35'E, 25 ° 40'N has been charted by using the EK-500 and ELAC-4700 echosounders since early 1991 on board the R/V Ocean Researcher 1. To date, as much as 90,000 bathymetric data points (employing the DGPS with positioning accuracy within 5 meters) were obtained during nine cruises totally about 2,500 nautical miles long (Fig.1). These data were examined, edited, and compiled; after that, bathymetrical contour chart annotated by the GRS-67 coordinate in the area was produced numerically (Fig.2). Until now, only the quality of the chart around the Pengchiahsu Island remains comparatively poor owing to the scarcity of bathymetrical data.

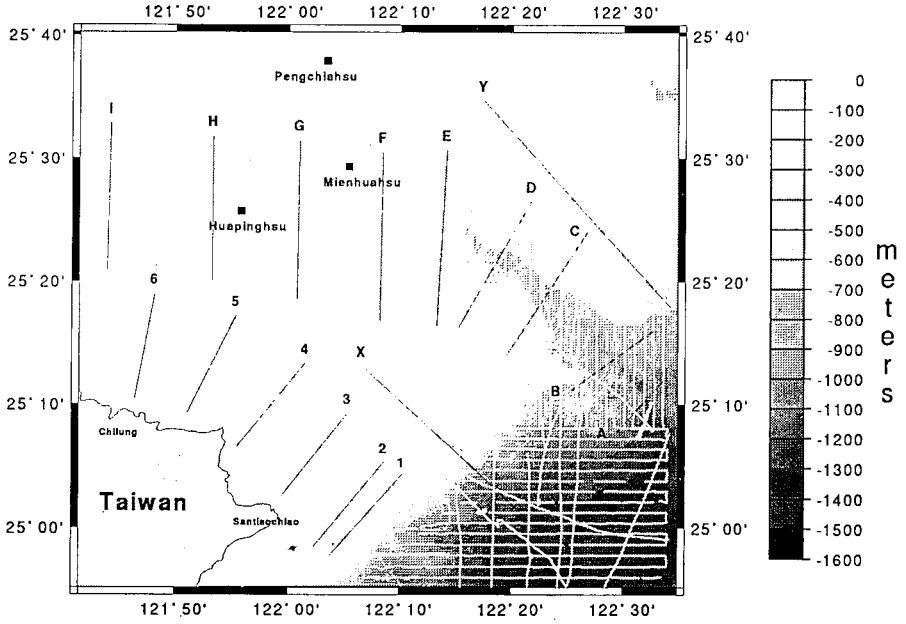

Fig.1. Surveying region map. White lines represent the ship tracks collecting bathymetrical data that uses in constructing water depth contour map; thin solid lines denote the profiles demonstrated in Fig.3, Fig.5 and Fig.6.

In the surveying area, the water depths increase in a southeast direction with a maximum depth of 1,530 m below sea level at the SE corner of the area. This area covers two major physiographic units as follows.

(1) East China Sea continental shelf: To the north of 25°30'N (northern shelf), the shelf surface is generally smooth and the shelf edge is at a depth near 130m (Fig.3), Nevertheless, the southern part of the this surface is no longer smooth and is featured with many ridges and valleys; and the shelf edge is lowered to a depth near 230 m. The relief in southern part of the shelf is tens meters on average, but may be as large as over 100m in the places where undersea ridges or islands are present (Fig.2 & Fig.4).

Hence, it is reasonable to believe that the southern shelf has been affected by certain tectonic disturbance and, consequently, the near-edge part of this shelf has been subsiding to some extent in relation to the stable northern shelf. It is also believed that the present shelf break was formed about 18,000 years ago when sea level stood at about 130m (Kennett, 1982). This means that northern shelf has been quite stable, while southern shelf subsides at a rate of 6mm/year which is comparable to the Early Pleistocene uplift rate of the Taiwan Island (Peng *et al.*, 1977; Barrier & AngeIier, 1986).

The sea floor off the northern Taiwan coast slopes with a gradient of 1° to 2° (or 1/25 to 1/50, see Fig.2) that is steeper than the average gradient (about 0.05° or 1/1000) of typical continental shelves. This implies that the southern shelf is also tectonically lowered in relation to the northeastern part of the Taiwan Island.

(2) East China Sea continental slope: Off the outer margin of the stable northern shelf, the continental slope descends at about 2° to the floor of the Southern Okinawa Trough; however, south of a submarine canyon off southern shelf, the slope becomes narrower and steeper (becomes at 4° downslope; see Fig.3). This may be due also to the tectonic disturbance.

There are two submarine canyons and one submarine valley shown in the region:

(i) Mien-Hua Canyon

Mien-Hua Canyon is well developed on the continental slope, beginning at the shelf edge near the islet of Mienhuahsu.

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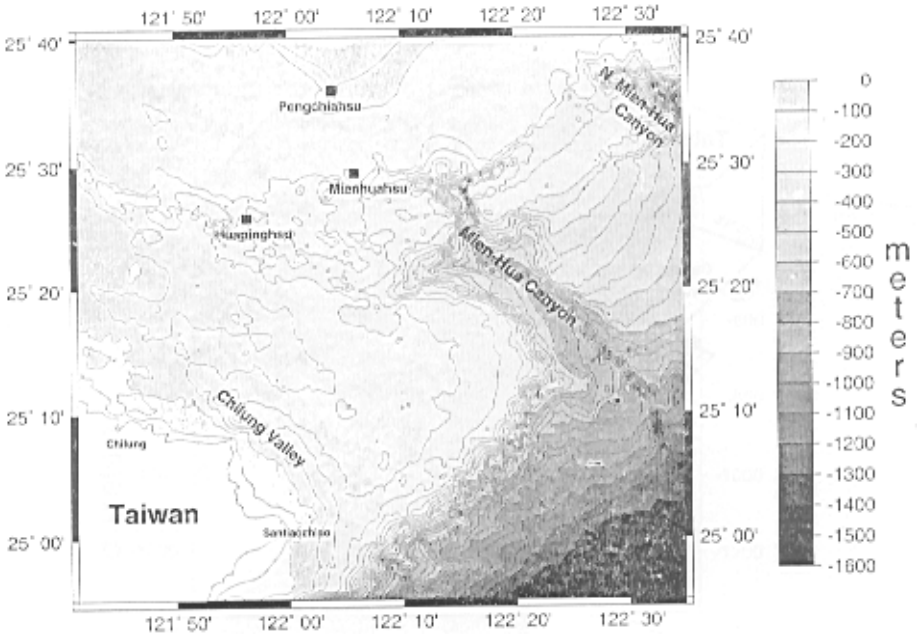

Fig.2. 2-D water depth contour map of the surveying region. Contour interval is at 50m.

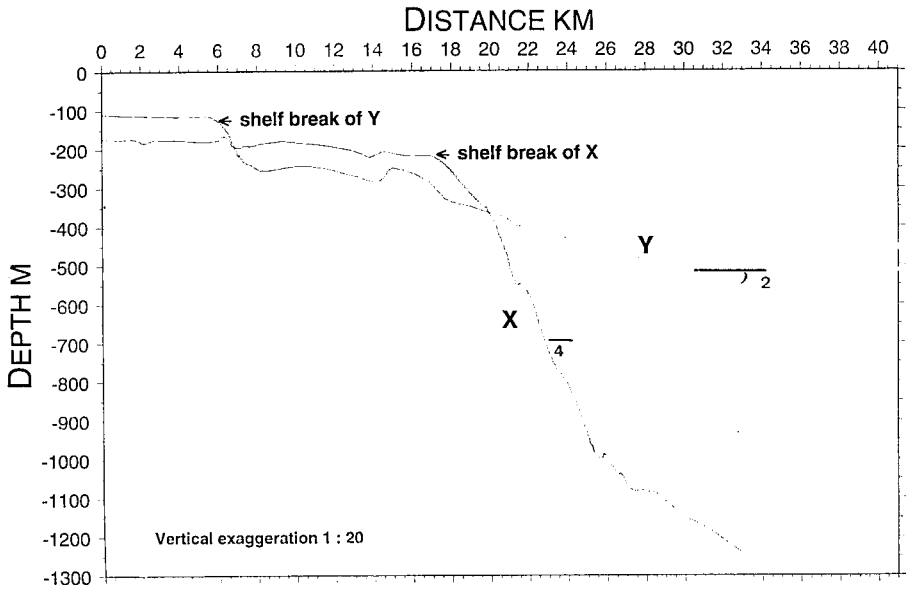

Fig.3. Selected profiles across the continental terrace in the surveying region. Locations of shelf-edge were pointed by the arrows. There profiles were interpolated from grided bathymetrical data. Positions of profile Y and profile X were shown in Fig.1. Vertical exaggeration is 1/20.

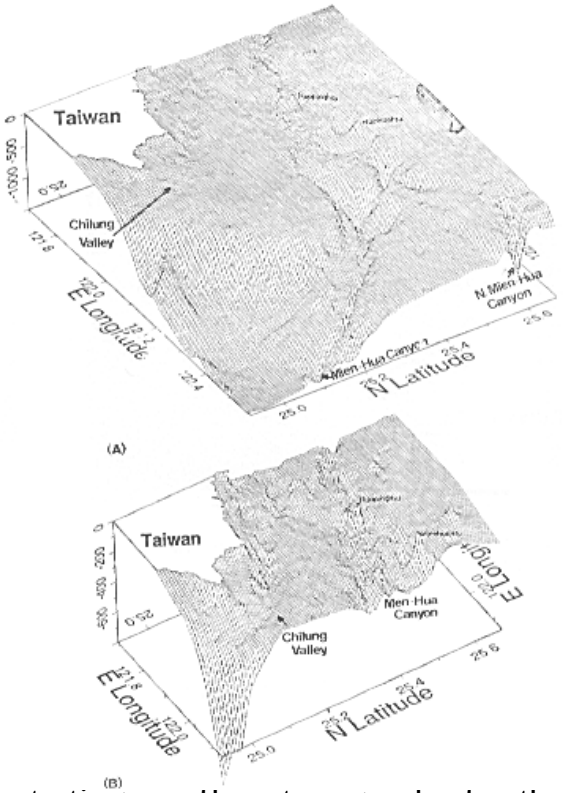

Fig.4. (A) 3-D map demonstrating sea floor topography for the area shown in Fig.2. (B) 3-D topographic map demonstrating sea floor relief shown on selected continental shelf region.

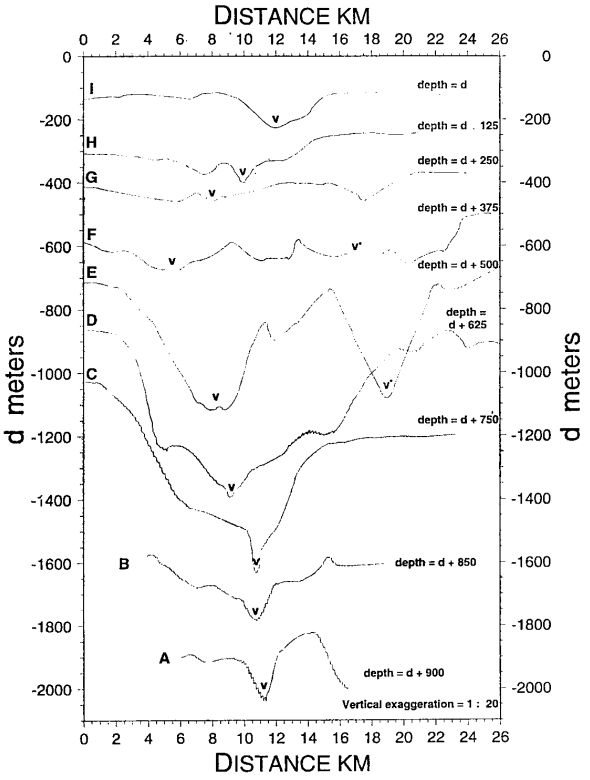

Fig.5. Selected profiles across the Mien-Hua Canyon in the continental slope (profiles A-E) and the shelf (profiles F-I) region. These profiles were interpolated from grided bathymetrical data. Positions of the profiles were shown in Fig.1. The axis of canyon floor for each profile is marked by the symbol "v", and marked by "v*" for canyon floor in its northern tributary.

The Mien-Hua Canyon is featured with steep walls and sinuous valleys of V shaped cross sections that fit the definition of a "canyon" according to Bouma (1990). The relief of this canyon at its axis is about 300-400 m near the shelf edge and averages 500m on the continental slope (Fig.5). The artery of the canyon running down the upper slope 15 km wide with considerably irregular floor sloping southeastward at a gradient of l° to the water depth of about 850 m. At this depth, the occurrence of fan-shaped deposits diminishes its dimension to less than 5 km wide and 200m in relief (Fig.2).

Yu (1992) chose the name "Huapinghsu Canyon" for this canyon for the reason that the "head" of the canyon is near the shelf edge where the islet of Huapinghsu is located However, this is not justified by our data.

Based on our data, the bathymetry shows that in the upper stream the canyon branches into two tributaries on the continental slope (Fig.2, Fig.4). One tributary in the south indents across the shelf edge and lies E-W across the continental shelf. It passes the south of Huapingsu in the form of a "valley" and extends further westward beyond the surveying region. The other tributary goes northwestward before disappearing in the vicinity of the islet of Mienhuahsu island.

If a submarine canyon commences on the continental shelf and connects with the mouth of a large river on land, its specific name usually follows the associated river name; however, if a canyon begins at shelf edge, it is a custom of naming the canyon by a geographic unit around its head (Bouma, 1990; Yu, 1992). Hence the choice of "Huapinghsu" by Yu (1992) as the name of this canyon is not a good choice, because this canyon only bypass Huapinghsu on the shelf. Instead, We prefer to name it "Mien-Hua Canyon" on the ground that this canyon climbs over the shelf edge near Mienhuahsu and commences on the shelf passing Huapinghsu.

(ii) North Mien-Hua Canyon

This canyon is located at the northeastern corner of surveying region, some 30 km north of the Mien-Hua canyon (Fig.2). It begins at the shelf edge and runs parallel to the Mien-Hua Canyon. We name this canyon "North Mien-Hua Canyon".

The North Mien-Hua Canyon is less than10 km wide and more than 300m in its relief. We do not know it in detail because its lower stream is out of our survey area. However, we do know that it is different from Mien-Hua Canyon and that it does not extend onto the continental shelf.

(iii) Chilung Valley

Another linear topographic low is found in this area and was named by Yu (1992) "Chilung Canyon". It is located about 10km north of and almost parallel to the coastline of northeastern Taiwan (Fig.2). This topographic low has an irregular relief about 20m along its floor axis. Clastic sediments cover the floor, especially in the offshore area near Chilung. This submarine feature is lack of some main characters of typical submarine canyon, e.g. it ends simply at the shelf edge, with no extension onto the continental slope, and most part of this linear depression are wide and shallow (Fig.6).

Therefore, it is better to term this low as a "valley", which defined by Bouma (1990) as "a relatively shallow, wide depression, the bottom of which usually has a continuous gradient", rather than a "canyon". So, we suggest the name "ChiIung Valley" to replace "Chilung Canyon".

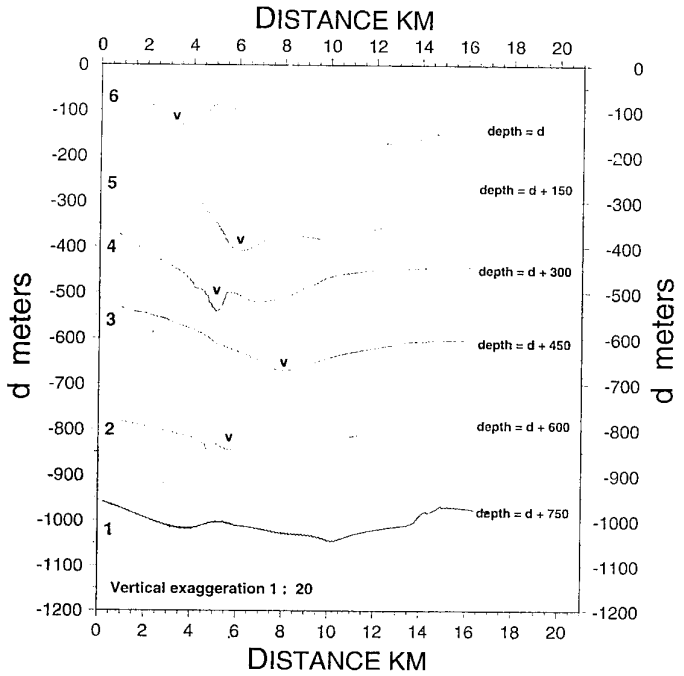

Fig.6. Selected profiles across the Chilung Valley. These profiles were interpolated from grided bathymetrical data. Positions of the profiles were shown in Fig.1. The axis of canyon floor for each profile is marked by the symbol "v". There is no detectable trace of the valley to be pointed out in the profile 1 which lies on the continental slope.

CONCLUSION

The two prominent valley-like submarine features in northeastern Taiwan were named by Yu (1992) The Chilung Canyon and the Huapinghsu Canyon. However, after further scrutiny of new bathymetric data and taking some considerations based on the naming rule for submarine features, we suggest that "Chilung Canyon" and "Huapinghsu Canyon" are better to be renamed "Chilung Valley" and "MienHua Canyon", respectively.

ACKNOWLEDGEMENTS

The new bathmetric data employed on this comment are part of the result of the project supported by the National Science Council of the Republic of China tinder the contracts of NSC 80-0209-M-002A-27, NSC 81-0209-M-002A-508-K03 and NSC 82-0208-D-002A-002. The authors like to express their appreciation to the crew and technicians aboard the R/V Ocean Researcher I in helping to collect the data; especially Mr. Shei-Tong Chu and Mr. Rong-Chong Chen. The more complete bathymetric chart will be available in the following half year.

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評論俞（1992）之「簡論臺灣東北海域海底峽谷之命名」

宋國士　　張逸中

摘　要

本文依 1992 及 1993 年所收集的水深資料，對俞何興 (1992) 提出之臺灣東北部海底峽谷命名建議修訂。「基隆峽谷」及「花瓶嶼峽谷」兩個海底谷狀低地，以分別改稱「基隆海谷」及「棉花峽谷」為宜。