CRUISE REPORT
R/V ROBERT D. CONRAD Cruise 26-12
October 19, 1985 - November 16, 1985
Dennis E. Hayes, Chief Scientist

RC26-12 was the first of a planned three-leg integrated geophysical survey of the northern continental margin and of the deep southwest sub-basin of the South China Sea. The project was conducted in cooperation with scientists from the Ministry of Geology of the People's Republic of China and Lamont-Doherty Geological Observatory. It represents the second phase of an ongoing collaborative effort which began in 1979. Three PRC scientists were aboard the R/V CONRAD during leg RC26-12.

The principal survey objectives of RC26-12 were to conduct about 2,000 km of wide-angle CDP, deep pentration seismic measurements and to shoot approximately 20 ESP profiles along two transects across the northern continental margin of the South China Sea basin. Both techniques required the use of the CONRAD and the HAIYANG 4 to shoot and receive. Gravity, magnetics, and 3.5 kHz seismic data were continuously acquired along all portions of CONRAD's underway track.

Cruise Narrative

C26-12 began on 19 October when the ship sailed from Hong Kong to Shekou Port in the PRC. We met there with scientists from the HAIYANG 4 to transfer personnel and to install Radist and Miniranger equipment. After long delays in obtaining official entry, the planning, personnel transfers, and installations proceeded. We had intended to sail on October 21 but a problem with the CONRAD gyro caused a delay. Once it became apparent that this problem could not be repaired on board, we decided to return to Hong Kong to obtain field service for both the gyro and the MARISAT system. Because the Chinese scientists now on board CONRAD did not have visas for Hong Kong, we were not allowed to sail there with any PRC personnel. We therefore sailed without the Chinese scientists, making the brief transit to Hong Kong where we received excellent service. Within about five hours of our arrival all repairs were completed and we departed from Hong Kong 0800 on 22 October toward a previously determined rendevous point near the eastern work area. The HAIYANG 4 unfortunately continued to lay in Shekou Port awaiting more information regarding Typhoon Dot which was moving slowly westward across the South China Sea near latitude 15°N.

The CONRAD arrived at the work area many hours before the HAIYANG 4. Because the northeast monsoons were intensified in the wake of Typhoon Dot, it took several hours to effect the necessary transfer at sea of Chinese scientists to the CONRAD. After this effort, both ships then proceeded to stream gear and to maneuver to begin the wide-angle CDP work along the eastern transect (see Fig. 1).

We began collecting wide-angle CDP data approximately 2200 hours local on 23 October, with our first line beginning between the mid-points of proposed ESP 9 and ESP 8. The monsoonal weather was a constant concern to the Chinese officers and scientists aboard the HAIYANG 4---sea states were consistently 4-6. At approximately 0800 on the morning of October 24 the HAIYANG 4 experienced a steering loss, took a large roll in the trough, and a wave broke over the after deck sweeping away one entire airgun array and towing gear. In the process of attempting to retrieve their MCS streamer, a section connector broke with approximately one-half of the streamer still out. The R/V CONRAD then took position information on the HAIYANG 4 so that we could help search for their lost streamer. At this time the winds were approximately 25 knots. We then proceeded to retrieve the CONRAD streamer and guns and spent the next several hours criss-crossing the region in search for the lost HAIYANG 4 streamer section---to no avail.

Because we were now unable to proceed with any of the planned two-ship operations, in consultation with the scientists aboard the HAIYANG 4, we were forced to drastically alter our science plan. CONRAD proceeded to the southwest sub-basin to implement portions of the proposed CDP program in the southwest sub-basin originally planned for leg 3 (RC26-14). In the meantime, HAIYANG 4 departed for Shan ou Port to assess the damage and to try to effect repairs.

At 0930 on the 25th of October we began a transit to the area north of Zhongsha (Maccelsfield) Bank to commence single-ship CDP work. On 27 October, about 1930 hours we slowed to stream the MCS gear and proceeded to begin CDP operations along two long northwest-southeast lines across the northern part of the southwestern sub-basin (see Figure 1).

After a period of about five days including various delays associated with concerns of the PRC scientists regarding weather, the HAIYANG 4 finally sailed from Shantou. On 2 November at 2200 hours we made radio contact with the HAIYANG 4 and formulated plans to begin at 1100 hours on the following day doing two-ship wide-angle CDP work between the rendevous point and the mid-point of proposed ESP 15. After many hours of maneuvering and discussing unresolved problems with the PRC gun and streamer arrays, the wide-angle CDP operations were delayed further. We then acquiesced to a joint operation that involved the HAIYANG 4 using only the two large Lamont airguns. While this was not entirely satisfactory it was better than no operations at all! We obtained our first WACDP shot at approximately 1510 hours on 3 November.

Wide-angle CDP operations continued then for approximately 3 days, on a track sub-parallel to the 2500-3000 meter isobaths along the continental margin and en route to the mid-point of proposed ESP 4 of the eastern transect. We then proceeded to shoot ESPs 4, 3, 2, and 1 in well coordinated operations with the HAIYANG 4. Maintaining the proper

rates of ship separation and constant "center points" for the ESPs was complicated by the fact that the HAIYANG 4 did not have any type of through-the-water speed log. Furthermore, their speed through the water could only be adjusted through a very narrow range of engine RPMs. These operations were largely directed from the CONRAD bridge by carefully monitoring the range distances between the two ships and the detailed information from CONRAD's Furuno speed log.

In most cases the ESPs were connected by piecewise continuous normal CDP lines shot by CONRAD. At the conclusion of ESP 1, CDP lines 505 and 506 were run to the starting point of ESP 5. ESP 5 operations began approximately 2100 hours on the 19 November. We then proceeded to work without major incident along the ESP transect shooting ESP lines 5, 6, 7, 8, and 9. Complications in navigation between the HAIYANG 4 and CONRAD necessitated a partial repeat of ESP 5 and a complete repeat of ESP 7.

After completion of ESP 9, both ships then transited to a region midway between the eastern and western ESP transects to near proposed ESPs 24. We then proceeded to shoot ESPs 24, 22' (which lay between the old proposed 23 and 22), and one half of ESP 23. ESP 23 was concluded at approximately 0930 local on the 15th of November. The MCS gear was then retrieved, PRC personnel were transferred back to the HAIYANG 4 and at about 1500 hours local, CONRAD began its ~160 mile transect directly to Hong Kong, concluding operations on cruise 26-12.

The ESP objectives along the western transect could not be implemented during leg RC26-12 because of scheduling and crew rotation constraints. However, the remainder of the project was rescheduled to include a short leg to implement the ESP operations along the western transect (ESP 11-21). The SEABEAM and heat flow operations were combined into a single leg of extended duration, one which would also complete the remainder of the CDP work originally planned for the southwest sub-basin. The results of those cruises are summarized in cruise reports RC26-13 and RC26-14.

General Comments

All the scientific equipment performed well and all technical support staff and scientists functioned admirably under difficult conditions of weather and complicated coordination of logistics with the HAIYANG 4. The special efforts of the First Engineer (Pica) and the Chief Mate (Martin) in effecting personnel transfers between the HAIYANG 4 and the CONRAD is gratefully acknowledged.

The data logging system worked adequately although there is presently no reasonable way to access the data logger information to effect near real time processing/examination of the data that has been logged. The

MCS system worked well: the DFS 4 had no problems, the streamer generally performed well--although under certain sea conditions maintaining the proper towing depth became difficult and selected channels proved unacceptably noisy. Three streamer sections were changed out during the course of the operations. The air guns and compressors performed extremely well with no unusual problems. The magnetometer worked well although the analog records appeared at times to be uncharacteristically noisy. The gravimeter also functioned well during the entire cruise except for a brief interval of extremely rough weather when the system was secured. The sonobuoy recording system functioned well although improvements could be made in simplifying the connections between the receivers, various analog recorders, and various digital recording options. The pneumatic sonobuoy launcher was quite successful--there were only one or two instances when the sonobuoy may have became entangled in the MCS streamer---a much higher success ratio than when deploying sonobuoys in the absence of a launcher.

The 3.5 kHz echo system performed reasonably well, although it seems that some fine tuning of the system could improve the signal to noise ratio, to provide a greater output level, and to operate with a shorter outgoing pulse to improve resolution. All navigation sensors performed very well, although the intermittent availability of GPS and the general unavailability of LORAN signals gave rise to a complicated merging of the data from these various sensors to effect a completely integrated navigation (this was not accomplished on board).

The lack of suitable software and the inability to input data recorded on the data logger into various microcomputers on the ship presently prevents any practical, near real time processing or analysis of the underway gravity, magnetics, topography or navigational data. This is a longstanding problem and is currently under review by an L-DGO committee. Attempts are being made to correct this situation by the middle of the 1986 operational year.

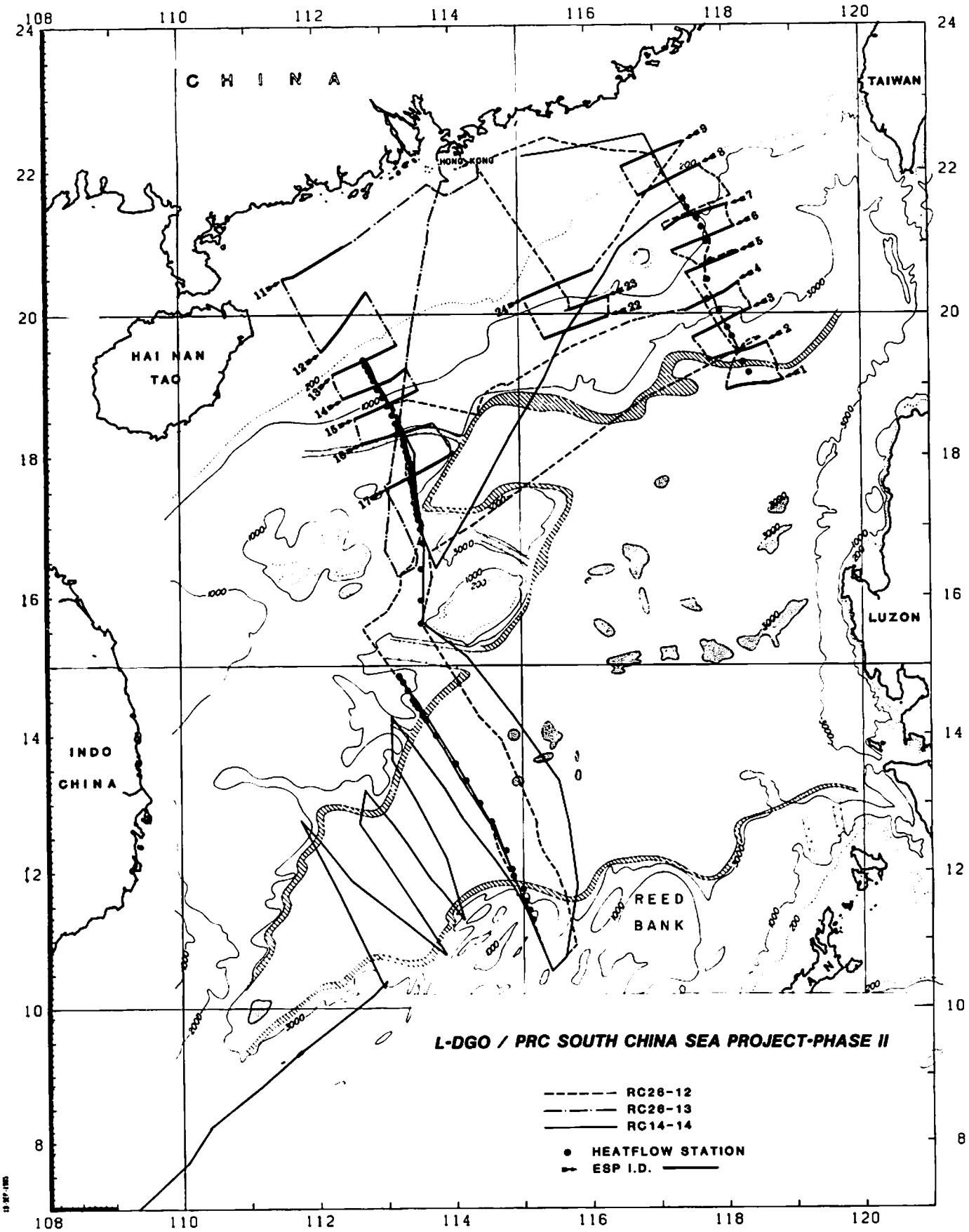
Special thanks go to the officers and crew for their interest and dedication in helping to effect a successful scientific program under difficult weather conditions. They asssumed considerable responsibility not only for CONRAD operations but for monitoring and advising many operations of the HAIYANG 4. Similarly, the scientists and technical support staff aboard the R/V CONRAD carried out their duties extremely well and none of the difficulties that were encountered were created by any shortcomings of the scientific staff. I particularly acknowledge the special efforts of Jim Smith, Science Officer on board, of Joe Stennett, Tom Aitken, and John Diebold who served on the HAIYANG 4, of Martin Iltzsche in maintaining the airguns and compressor system, and of Steve Lewis who served as a deputy Chief Scientist for the duration of the leg.

The ship track is shown in Figure 1. Participating personnel are listed in Appendix I.

APPENDIX I

Scientific Personnel RC 26-12
October 16 - November 16, 1985
Hong Kong - Hong Kong

1.	Hayes, Dennis E.	Chief Scientist
2.	Lewis, Stephen D.	Deputy Chief Scientist
3.	Buhl, Peter	Scientist
4.	Leyden, Robert J.	Scientist
5.	Smith, James A.	Science Officer
6.	Spangler, Susan E.	Student
7.	Diebold, John B.	Scientist on HAIYANG 4
8.	Aitken, Thomas D.	Scientist on HAIYANG 4
9.	Stennett, Joseph	MCS Engineer on HAIYANG 4
10.	LaBrecque, Steve P.	E. T.
11.	Feigl, Kurt	Comp. Operator
12.	Iltzsche, Martin W.	Airgun
13.	Qali, Ropate	Airgun
14.	DiBernardo, John	Airgun
15.	Kegarty, Kerry A.	Scientist (Univ. of Melbourne)
16.	Ruppert, Steven D.	Student (Hawaii Inst. of Geophysics)
17.	Wang, Junsheng	Scientist (People's Republic of China)
18.	Liu, Chang-Ju	Scientist " " "
19.	Ye, Yaohau	Scientist " " "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C H I N A
TAIWAN
HONG KONG
HAI NAN TAO
INDO CHINA
LUZON
REED BANK
L-DGO / PRC SOUTH CHINA SEA PROJECT-PHASE II
RC26-12
RC26-13
RC14-14
HEATFLOW STATION
ESP I.D.

Figure 1.