Cruise Report

U.S.-R.O.C. Deep Seismic Imaging Study of the Taiwan Arc-Continent Collision (Project TAICRUST)

— *R/V Ocean Researcher I* Cruise Nos. 429 and 430

As a part of a cooperative project between the U.S. and the Republic of China (Taiwan) to study the deep seismic structure in and around Taiwan, we participated in two consecutive cruises of *R/V Ocean Researcher I*, operated by the Institute of Oceanography of National Taiwan University. Our responsibility was to deploy and retrieve ocean-bottom seismographs in order to record large-offset seismic signals from an air-gun array on *R/V Maurice Ewing* while the *Ewing* was conducting a normal multi-channel seismic survey.

The first cruise (hereafter called leg 1 for convenience) was from August 24 through September 13, 1995, from Keelug to Kaohsiung, and the second cruise (called leg 2 for convenience) was from September 15 through 20, 1995, from Kaohsiung to Kaohsiung. As explained in detail later in a chronological description of the cruises, these dates and the final port were significantly altered from the original plan of August 23 through September 7, Keelung to Kaohsiung, for the first leg and September 11 through 22, Kaohsiung to Keelung, for the second leg due to numerous typhoons, which repeatedly forced us to change our schedule.

The following UTIG personnel participated in the cruises: Yosio Nakamura (co-chief scientist on leg 1), Kirk McIntosh (co-chief scientist on leg 2), Glen Caglarcan (leg 1 only), Stephane Operto, Julia Liu. Other members of the scientific party on board *Ocean Researcher I* were: from National Taiwan Ocean University (NTOU): Tan-Kin Wang (co-chief scientist on leg 1; leg 1 only), Tain-Syh Liu (first 5 days of leg 1 only), Chun-Hsien Chiang (leg 1 only), Allen Chen (co-chief scientist on leg 2; leg 2 only), Miao-Chang Lai (leg 2 only), Min-Lang Yang (leg 2 only), Cheng-Hsing Wu (leg 2 only); from Australian Geological Survey Organisation (AGSO): Chao-Shing Lee, Jack Pittar. Participants of the projects on board *R/V Ewing*, cruise No. EW9509, included Char-Shine Liu of National Taiwan University, Don Reed of San Jose State University, Greg Moore of University of Hawaii and Neil Lundberg of Florida State University. Organizations in charge of onshore recording included Academia Sinica, Central Weather Bureau of Taiwan, National Central University and State University of New York at Binghamton (Francis Wu). Other scientists participating in the project include How-Wei Chen of National Chung-Cheng University and Tung-Yi Lee of National Normal University.

In summary, we deployed a total of 39 OBS's along six seismic lines, all but two of which were onshore-offshore lines involving land stations operated by several organizations in Taiwan. All OBS's were recovered on time and all but one of them recorded full data. The only exception was a Taiwanese OBS which developed a disk-write problem caused by a faulty assembly of one of the circuit boards and lost about 1/3 of the data. All deployments were made during the first leg, and none were made during the second leg. The 39 deployments amount to 61% of the 64 deployments originally planned for the project. The fewer than planned deployments were entirely due to adverse weather conditions we encountered repeatedly during the experiment.

The first two-thirds of leg 1, covering the eastern offshore of Taiwan was supported entirely by the funding from the National Science Council (NSC) of Taiwan, and the last third of leg 1 and the entire leg 2, covering the southern offshore of Taiwan, were jointly funded by the National Science Foundation (NSF) and NSC.

The OBS operation, planned to be a joint effort of UTIG and NTOU, was severely constrained when our technician, Glen Caglarcan, turned in a letter of resignation a few days before he was to leave for Taiwan, and NTOU failed to hire and train a new technician after their technician resigned earlier this year. As it happened, Glen agreed to participate only in the first leg of the cruise, the newly hired NTOU technician, Mr. Tain-Syh Liu, was entirely out of service due to sea sickness and had to be taken off the ship after 5 days at sea, and an NTOU EE graduate student, Mr. Chen-Hsing Wu, who was brought into the

project to help in the OBS operation, was not able to communicate with us at all. What saved us were the two Australians, Dr. Chao-Shing Lee and Mr. Jack Pittar of AGSO, who were on board as observers/trainees of OBS operation in preparation for a planned OBS cruise on board *R/V Rig Seismic* on the Northwest Shelf of Australia later this year using our OBS's. They were of tremendous help on every occasion. We were very fortunate that these two Australians joined us in the cruise. We could not have done what we did without their contribution.

Chronological description of the cruise follows:

Monday, August 7: Yosio Nakamura and Glen Caglarcan arrived at Keelung in advance to prepare NTOU OBS units.

Wednesday, August 16: *R/V Ocean Researcher I* arrived at Pi-Sha harbor in Keelung in the morning (~10 a.m.). The shipment of OBS equipment from Austin arrived late afternoon and was delivered directly to the ship (~5:30 p.m.).

Saturday, August 19: Julia Liu arrived from her home in Tainan shortly after noon. Chao-Shing Lee and Jack Pittar of AGSO arrived from Canberra late afternoon. Kirk McIntosh and Stephane Operto arrived from Austin late in the evening.

Sunday, August 20: Started preparation of OBS's for deployment on line 1.

Monday, August 21: A pre-cruise meeting in the afternoon on board *R/V Maurice Ewing* in Port of Keelung.

Tuesday, August 22: Reception at NTOU for the participants of the project and the Taiwanese officials, hosted by the Institute of Oceanography of National Taiwan University and the Institute of Applied Geophysics of National Taiwan Ocean University. The reception was followed by a tour of *R/V Ocean Researcher I* and *R/V Maurice Ewing*.

Wednesday, August 23: Scheduled departure of *R/V Ocean Researcher I* from Keelung at 10 a.m. was postponed till the following day due to an approaching typhoon, Janis. *R/V Maurice Ewing* left Keelung in the afternoon (~3:30 p.m.). A new schedule for a shorter line 1 was worked out and faxed to *Ewing*.

Thursday, August 24: *R/V Ocean Researcher I* left dock at Pi-Sha harbor in Keelung at 7:22 a.m. Started deployment of OBS's on line 1 mid afternoon, starting at station 5. (Stations 1-4 were skipped.) Line 1 crossed the Okinawa trough, Ryukyu volcanic arc, Nan-ao basin, the fore-arc high, Ryukyu trench and the westernmost Philippine Sea plate, from north to south.

Friday, August 25: Deployment of OBS's on line 1 continued till late afternoon. (Stations 7 and 14 were skipped also due to time constraints.) *R/V Ewing* reported very strong *Kuroshio* current from south against the ship's progress.

Saturday, August 26: Met *R/V Ewing* shooting line 1 on way to recover OBS at station 5 (~3:30 p.m.). Started recovery of OBS's on line 1 mid afternoon.

Sunday, August 27: Recovery of OBS's on line 1 continued all day, ending at shortly before midnight. Started preparation of OBS's for the following two lines, but abandoned it when another approaching typhoon, Kent, threatened to hit the area.

Monday, August 28: Stood by off Hualien watching the movement of the typhoon, and then decided to go back to Keelung ahead of the typhoon's arrival in the area.

Tuesday, August 29: Arrived at the Taiwan Fisheries Research Institute dock in Keelung mid morning (~10 a.m.) to avoid the approaching typhoon.

Wednesday, August 30: Stayed in port as the typhoon was still in the area. After consulting *R/V Ewing*, revised schedule for the next two lines and started preparation of 12 OBS's for the lines.

Thursday, August 31: Left dock at Taiwan Fisheries Research Institute in Keelung at 9:55 a.m. as the typhoon moved west to South China Sea. Arrived at station 20 on line 14 at around midnight. Line 14 was a east-west line through the middle of the Nan-ao basin.

Friday, September 1: Started deployment of 7 OBS's at stations 20 through 26 on line 14 shortly after midnight, ending mid morning. Established a radio contact with *R/V Ewing* to arrange for a data exchange later in the afternoon. At around 1:30 p.m., a Japanese Coast Guard patrol boat PC212 approached, asking questions. At a distance, *R/V Ewing* was seen followed by a larger Japanese Coast Guard vessel PL124. Apparently, the *Ewing* violated the Japanese territorial waters earlier in the morning when she went between Japanese islands while actively performing MCS operation. At around 2:30 p.m., a Zodiac from the *Ewing* arrived to bring a reporter and a cameraman for a Taiwanese public television and with them the navigation and shot time data for line 1. *R/V Ewing*'s trouble with a Japanese Coast Guard vessel continued till about 6 p.m., when the *Ewing*'s captain, overheard on the ship's radio, admitted violating the Japanese territorial waters, and the *Ewing* was finally released.

Saturday, September 2: Started deployment of the five Taiwanese OBS's for the first time at stations 15 through 19 on line 16 at 8 a.m., and completing the deployment at around 5 p.m. This was the first onshore-offshore line, and ran along the northern edge of the Nan-ao basin. Kirk and Stephane started processing of the line 1 data with the navigation and shot time data from the *Ewing*.

Sunday, September 3: Recovered the 7 OBS's on line 14 starting early in the morning (~5 a.m.) and ending early evening (~8 p.m.). We were informed of the potential shortage of food on board if we were to complete the remaining lines of leg 1 before the scheduled port call at Kaohsiung. It was decided, therefore, to go to Hualien on our way to the next line after the line 16 recovery to replenish our provisions.

Monday, September 4: Recovered the 5 Taiwanese OBS's from line 16 starting at around 1:30 a.m. and completing early afternoon (~1:15 p.m.). Arrived at Hualien at 3 p.m. for an unscheduled port call.

Tuesday, September 5: Departed from Hualien at 8:45 a.m. Started deployment of 7 OBS's at stations 27 through 33 on line 23 early evening (~6:30 p.m.). Line 23 was the second onshore-offshore line running northwest-southeast on the Philippine Sea plate.

Wednesday, September 6: Completed deployment of OBS's on line 23 early morning (~4 a.m.), and started preparation of OBS's for the next two lines.

Thursday, September 7: Met *R/V Ewing* in the morning along line 23 and picked up a bottle containing navigation and shot data from lines 14 and 16. Started recovery of OBS's on line 23 early evening (~7 p.m.).

Friday, September 8: Completed recovery of OBS's on line 23 mid morning (~9 a.m.). This was the end of the eastern transects. Immediately continued on the southern transect with the deployment of 6 OBS's at stations 34 through 39 on line 29, the eastern offshore portion of the third onshore-offshore line across the Hengchun Peninsula, from mid afternoon (~3 p.m.) to late night (~10:30 p.m.).

Saturday, September 9: Deployed 6 OBS's at stations 40 through 45 on line 33, the western offshore portion of the third onshore-offshore line across the Hengchun Peninsula, from early morning (~2:30 a.m.) to mid morning (~8:30 a.m.). Celebrated the Mid-Autumn Festival (August 15 of lunar calendar).

Sunday, September 10: Met with *R/V Ewing* mid morning along line 29 and picked up a bottle containing navigation and shot data from the *Ewing* (9:48 a.m.).

Monday, September 11; Started recovery of OBS's from line 29 in the early evening (~6 p.m.).

Tuesday, September 12: Completed recovery of OBS's from line 29 early morning (~4 a.m.). Started recovery of OBS's on line 33 in the afternoon (~1 p.m.).

Wednesday, September 13: Completed recovery of OBS's on line 33 shortly after midnight (~1 a.m.). Abandoned a plan to meet the *Ewing* for another data transfer to allow a member of the scientific party to catch a plane in the morning, and headed to Kaohsiung for a port call, arriving at Kaohsiung at around 5:45 a.m., thus ending the leg 1, or *Ocean Researcher I* cruise No. 429. Glen Caglarcan left for Austin. Tan-Kin Wang and Chun-Hsien Chiang left for Keelung, and four new NTOU participants, Allen Chen and three students, Miao-Chang Lai, Min-Lanhg Yang and Cheng-Hsing Wu, arrived from Keelung. Started preparation of OBS's for stations 46 through 64 on the last three lines, 45, 47 and 49. Julia Liu left to visit her parents in Tainan.

Thursday, September 14: Continued preparation of OBS's for the last three lines, although most people were off for the day. The weather report showed three typhoons/tropical storms in the area: two in the Philippine Sea (Oscar and Polly), and one in the South China Sea (Ryan). The weather prediction in the experiment area was not favorable with high winds and huge waves.

Friday, September 15: Continued preparation of OBS's for the last three lines, putting instruments in spheres for stations up to 55. Received message from the *Ewing* that they lost the last seven sections of the MCS streamer to a ship that ran over it in rough weather. Julia Liu returned to ship mid afternoon. The ship left port late afternoon (5:15 p.m.) to start leg 2, or *Ocean Researcher I* cruise No. 430. The sea condition worsened as we proceeded west towards the first OBS deployment site at station 46 on line 45.

Saturday, September 16: After contacting the *Ewing* on the ship's radio, and learning that they were still working on the streamer repair, we decided not to deploy OBS's on line 45 as planned. The ten spheres that had been closed were opened up and all the remaining OBS's were stopped. A new OBS deployment/recovery schedule was worked out for the last two remaining lines. The captain decided to seek a calmer waters near the western shore of Hengchun Peninsula as the ship's excessive rolling made it difficult for the technician to work on the instruments.

Sunday, September 17: At mid-afternoon (3:45 p.m..) the ship anchored off the west coast of Hengchun Peninsula at 28°18.87'N, 120°35.92'E in the Fang-liao anchorage. Requested an extension of *Ocean Researcher I* ship time to September 25 to accommodate expected delay of shooting of the last two lines.

Monday, September 18: Prepared OBS's for possible deployment on the last two lines if the weather permitted. Typhoon Oscar moved north to hit Japan, causing some damage there, and typhoon Polly moved northeast away from our area, but typhoon Ryan was still stationary in the South China Sea and strengthening. The ship remained on anchor all day.

Tuesday, September 19: Fax message from the *Ewing* indicated a worsening sea condition in the Bashi Straight with no hope for any OBS work in the area until typhoon Ryan went away. Our only hope was for Ryan to quickly go away and then we might complete the one last line before returning to Keelung. Reprogrammed eight OBS's in preparation for this last-resort scenario. The ship remained anchored at Fang-liao anchorage all day, but with a new weather forecast that indicated the northeasterly move of Ryan towards us, captain decided to return to Kaohsiung early in the morning to escape from Ryan.

Wednesday, September 20: Left Fang-liao anchorage early in the morning and returned to Kaohsiung at 7:45 a.m. Julia Liu left ship to return to Austin.

Thursday, September 21: With no chance to follow even the last-resort plan, the captain and the chief scientist decided to terminate the cruise as of noon tomorrow in Kaohsiung without returning to Keelung as originally planned. Stopped all the OBS's that had been prepared for the last line, closed down the operation and started packing the equipment. Chao-Shing Lee made arrangement with U-

Freight, the agent in Taipei for Ghedi International, for the shipment of equipment from Kaohsiung instead of Keelung.

Friday, September 22: Typhoon Ryan passed just south of Taiwan, through the site of our experiment, at about 8 o'clock in the morning. Packed equipment to be shipped to Canberra and Austin. The three students from NTOU left ship. *Ocean Researcher* cruise No. 430 officially ended at noon, and captain Hwang left ship to return to Taipei.

Saturday, September 23: The shipping agent picked up our equipment to be air-freighted to Canberra (35) and Austin (5 boxes) from the ship. Allen Chen flew to Taipei in the morning, and Chao Shing Lee and Jack Pittar flew to Taipei in the afternoon.

Sunday, September 24: Kirk McIntosh, Stephane Operto and Yosio Nakamura left Kaohsiung on a train, returning to Keelung in late afternoon.

Monday, September 25: Stephane Operto left Keelung in the morning for Taipei. Cleaned up the lab at NTOU in preparation for receiving NTOU OBS equipment from the ship.

Tuesday, September 26: *R/V Ocean Researcher I* returned to Pi-sha Harbor in Keelung. NTOU OBS equipment removed from the ship, serviced, and stored away. Stephane Operto left Taipei for Austin.

Wednesday, September 27: Kirk McIntosh and Yosio Nakamura left Keelung in the morning, and met with Char-Shine Liu of National Taiwan University in Taipei. Yosio Nakamura left Taipei in the afternoon for Austin.

Figure 1 shows the planned seismic lines and locations of OBS stations (triangles). Seismic lines are designated by the way-point number (in a box) at the beginning of the line, but because of the numerous changes in the ways these lines were shot, the actual line numbers no longer correspond to the way point numbers shown on this map. Thus, line 14 lies between way-points 12 and 11, line 16 lies between way-points 10 and 9, line 23 runs from way-point 17 to about 2/3 of the way towards way-point 16, line 29 lies between way-points 22 and 23, and line 33 lies between way-points 26 and 27 on this map. No OBS's were deployed along line 45, which runs between way-points 31 and 32, nor along lines 47 and 49, which were planned to occupy between way-points 39-38 and 37-36, respectively, but were not shot. The lines actually shot and the OBS stations actually occupied are shown in Fig 2.

Table 1 gives the sensors and recording parameters used for the experiment, and Table 2 lists the OBS station locations and data coverage.

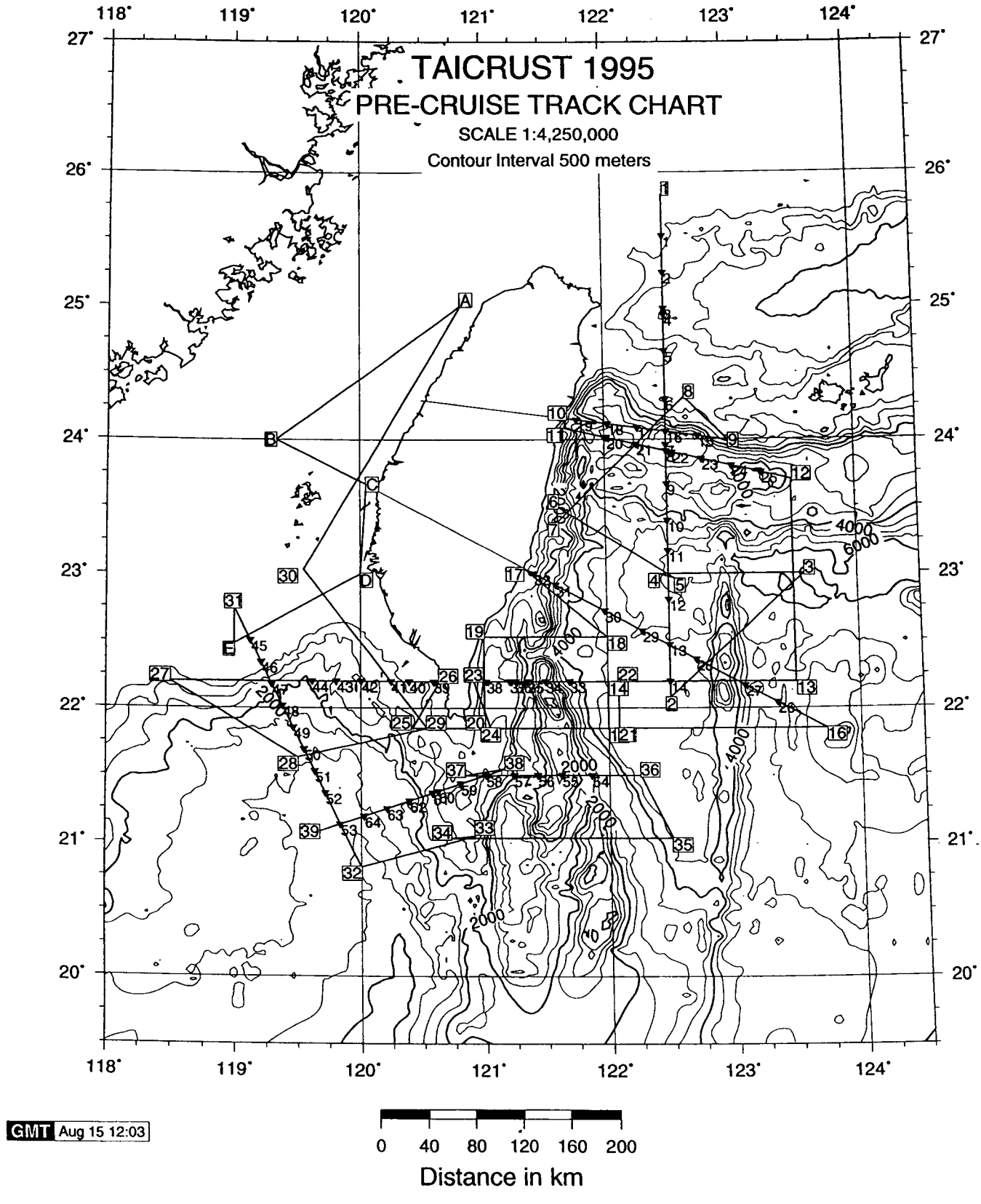

Fig. 1 Planned seismic lines and locations of OBS stations (triangles).

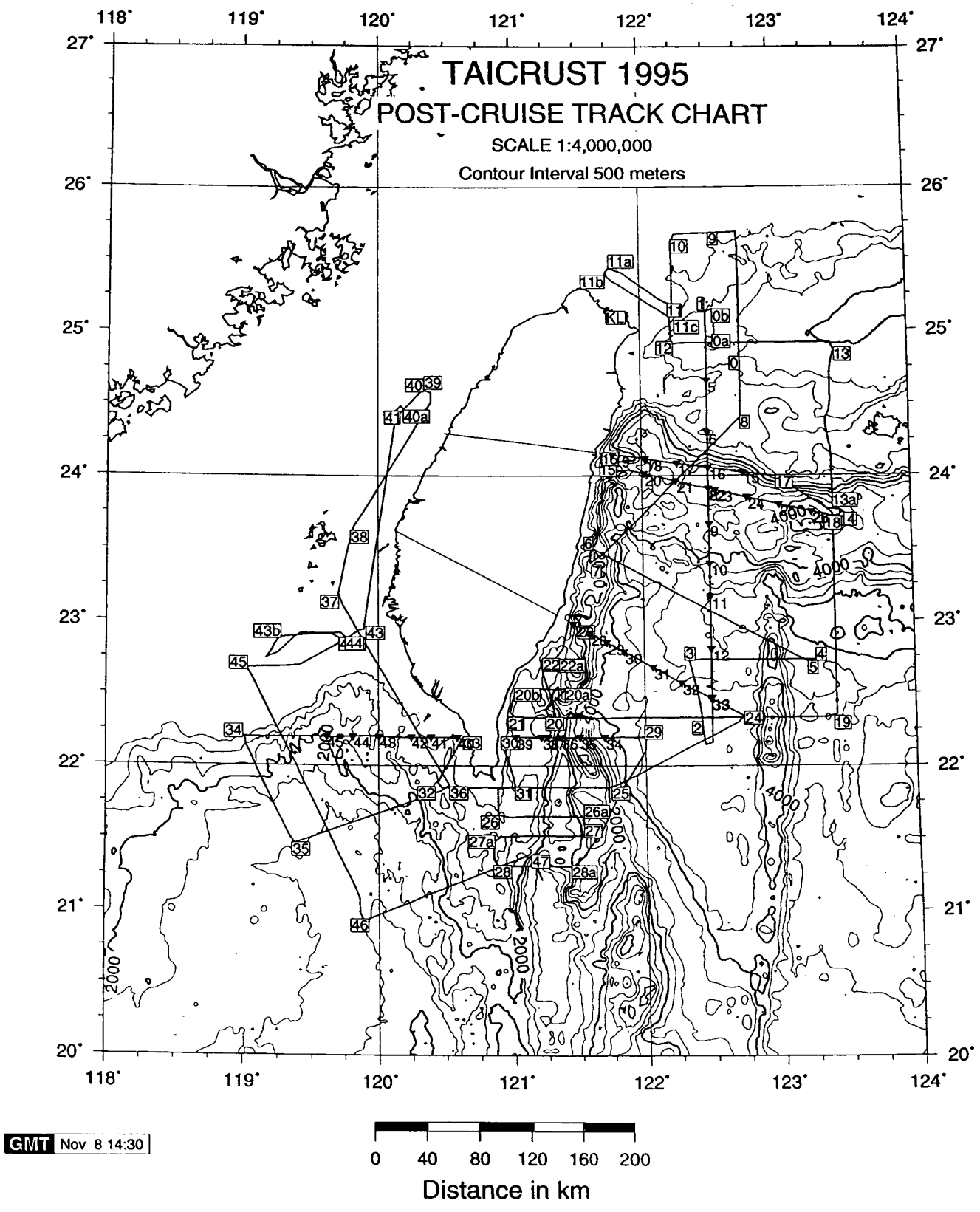

Fig. 2 Seismic lines actually shot by *R/V Maurice Ewing* and OBS stations actually occupied.

Table 1. OBS Recording Parameters

Sensors:	Channels 1-3:	3-component gimbaled geophones, Mark Products L-15B, 4.5 Hz
	Channel 4:	Hydrophone, Ocean Acoustic Research E-2PD
Sensitivity (unit digitizing level):	Channels 1-3:	2.1 nm/s
	Channel 4:	1.0 mPa
Polarity:	Channel 1:	vertical, positive down
	Channels 2, 3:	horizontal, — orientation to be determined from recorded water wave arrivals; channels 1, 2 and 3 form a right-hand system
	Channel 4:	positive for increasing pressure
Alias filter frequency and rolloff:	Channels 1-3:	30 Hz, -24 dB/oct
	Channel 4:	50 Hz, -24 dB/oct
A/D conversion:	14 bits plus dynamic gain ranging	
Dynamic range:	126 dB	
Sample interval:	3.9974 ms	
Data acquisition mode:	Continuous with a short gap at data transfer to disk approximately every 283 s (4-channels) or 370 s (3-channels)	

Table 2. TAICRUST OBS Deployment, Recovery and Data Summary

Line	Station	Chassis S/N	Sphere S/N	Active Channels	Deployment			Recovery			Acquired Data		
					Time	Location	Depth m	Time	Location	Depth m	Period	Hrs.	Mb
1	1	HT-8	52542	1-3	Not deployed								
	2	HT-7	49814	1-3	Not deployed								
	3	HT-6	49812	1-3	Not deployed								
	4	94-6	55429	1-4	Not deployed								
	5	94-7	55454	1-4	8/24 14:17	24°39.64'N 122°30.04'E	442	8/26 14:54	24°40.34'N 122°30.58'E	452	8/24/19:00-8/26/01:00	30	191
	6	94-8	55458	1-4	8/24 17:52	24°17.90'N 122°29.88'E	290	8/26 18:11	24°18.50'N 122°30.42'E	375	8/25/01:00-8/26/07:02	30	191
	7	94-9	55467	1-4	Not deployed								
	8	94-10	55472	1-4	8/25 03:58	23°54.87'N 122°29.96'E	3640	8/27 01:10	23°55.28'N 122°30.36'E	3630	8/25/07:00-8/26/16:01	33	210
	9	94-11	55478	1-4	8/25 06:12	23°40.01'N 122°30.01'E	2900	8/27 04:52	23°40.654'N 122°30.46'E	3100	8/25/10:00-8/26/19:01	33	210
	10	94-12	55496	1-4	8/25 08:41	23°23.77'N 122°30.01'E	4400?	8/27 08:53	23°24.43'N 122°30.22'E	4500	8/25/14:00-8/26/23:01	33	210
	11	94-13	55497	1-4	8/25 11:19	23°10.31'N 122°29.94'E	5560	8/27 12:42	23°10.50'N 122°30.23'E	~5600	8/25/18:00-8/27/03:00	33	210
	12	94-15	55962	1-4	8/25 14:32	22°48.46'N 122°30.01'E	5300	8/27 18:14	22°48.77'N 122°30.06'E	5260	8/25/23:00-8/27/08:03	33	210.5
	13	94-16	57112	1-4	8/25 17:14	22°28.43'N 122°30.00'E	4933	8/27 23:32	22°28.88'N 122°29.59'E	4905	8/26/04:00-8/27/08:03	28	213
	14	94-17	57113	1-4	Not deployed								
16	15	HT-8	55542	1-3	9/2 08:00	24°01.59'N 122°45.34'E	3450	9/4 01:35	24°02.07'N 122°46.00'E	3200	9/2/22:00-9/3/19:01	21	102
	16	HT-7	49814	1-3	9/2 09:52	24°03.50'N 122°30.00'E	3600	9/4 04:42	24°04.47'N 122°30.77'E	3250	9/2/22:00-9/3/19:03	21	102.5
	17	HT-6	49812	1-3	9/2 12:05	24°05.22'N 122°16.15'E	3420	9/4 07:17	24°05.93'N 122°16.65'E	3250	9/2/22:00-9/3/19:00	21	103
	18	HT-5	49186	1-3	9/2 14:10	24°07.02'N 122°01.58'E	2680	9/4 10:13	24°07.71'N 122°02.08'E	2650	9/2/22:00-9/3/19:00	21	103
	19	HT-4	46996	1-3	9/2 16:55	24°08.79'N 121°46.93'E	1006	9/4 13:13	24°08.93'N 121°46.76'E	1000	9/2/22:00-9/3/18:32	20.5	67.5

14	20	94-18	55429	1-4	9/1 00:01	24°00.90'N 122°01.02'E	2960	9/3 05:03	24°01.56'N 122°01.49'E	3000	9/1/16:00-9/3/03:02	35	223
	21	94-6	55454	1-4	9/1 02:25	23°57.89'N 122°15.45'E	3100	9/3 07:44	23°58.69'N 122°15.79'E	3150	9/1/16:00-9/3/03:03	35	223
	22	94-9	55458	1-4	9/1 04:30	23°54.81'N 122°30.00'E	3630	9/3 10:27	23°55.46'N 122°30.54'E	3650	9/1/16:00-9/3/03:01	35	222.5
	23	94-17	55467	1-4	9/1 05:01	23°54.23'N 122°32.83'E	3650	9/3 11:42	23°54.81'N 122°33.25'E	3650	9/1/16:00-9/3/03:01	35	222.5
	24	94-7	55472	1-4	9/1 06:38	23°51.24'N 122°47.14'E	3600	9/3 14:37	23°51.87'N 122°47.58'E	3550	9/1/16:00-9/3/03:02	35	223
	25	94-8	55478	1-4	9/1 08:21	23°48.18'N 123°01.32'E	3800	9/3 16:59	23°48.40'N 123°01.82'E	3760	9/1/16:00-9/3/03:03	35	223
	26	94-10	55496	1-4	9/1 10:09	23°45.07'N 123°15.62'E	4550	9/3 19:48	23°45.01'N 123°16.08'E	4550	9/1/16:00-9/3/03:04	35	223
23	27	94-11	55454	1-4	9/5 18:24	22°58.91'N 121°27.71'E	1133	9/8 09:12	22°59.58'N 121°28.30'E	1501	9/6/12:00-9/7/17:01	29	184.5
	28	9412	55497	1-4	9/5 19:22	22°55.03'N 121°35.69'E	3050	9/8 07:09	22°55.86'N 121°35.78'E	3039	9/6/12:00-9/7/17:01	29	184.5
	29	94-13	55962	1-4	9/5 20:22	22°51.27'N 121°43.20'E	3608	9/8 05:06	22°51.62'N 121°43.16'E	3548	9/6/12:00-9/7/17:00	29	184.5
	30	94-15	57112	1-4	9/5 21:36	22°47.39'N 121°50.97'E	4160	9/8 03:06	22°47.86'N 121°50.78'E	4130	9/6/12:00-9/7/17:04	29	185
	31	94-16	55467	1-4	9/5 23:57	22°40.92'N 122°04.01'E	4760	9/8 00:25	22°41.38'N 122°03.74'E	4681	9/6/12:00-9/7/17:00	29	184.5
	32	94-18	55429	1-4	9/6 01:41	22°34.54'N 122°16.71'E	5209	9/7 21:58	22°35.25'N 122°16.64'E	5240	9/6/12:00-9/7/17:04	29	185
	33	94-6	55458	1-4	9/6 03:40	22°28.09'N 122°29.48'E	4901	9/7 19:04	22°28.45'N 122°29.27'E	4901	9/6/12:00-9/7/17:00	29	184.5
29	34	HT-8	49186	1-3	9/8 15:15	22°12.05'N 121°41.69'E	3550	9/11 18:13	22°11.86'N 121°41.58'E	3550	9/10/00:00-9/10/21:01 9/11/06:00-9/11/15.03	30	146
	35	94-9	55458	1-4	9/8 16:57	22°12.08'N 121°30.00'E	950	9/11 20:33	22°12.21'N 121°29.85'E	1000	9/10/00:00-9/10/21:00 9/11/06:00-9/11/18.02	33	210
	36	94-17	44429	1-4	9/8 18:06	22°12.07'N 121°21.37'E	2730	9/11 22:43	22°12.31'N 121°21.24'E	2750	9/10/00:00-9/10/21:04 9/11/06:00-9/11/21.00	36	229.5
	37	94-7	55467	1-4	9/8 18:55	22°12.04'N 121°15.42'E	994	9/12 00:15	22°12.70'N 121°15.31'E	900	9/10/00:00-9/10/21:01 9/11/06:00-9/11/23.02	38	241.5
	38	94-8	57112	1-4	9/8 19:17	22°12.05'N 121°12.54'E	1049	9/12 01:29	22°12.46'N 121°12.61'E	1000	9/10/00:00-9/10/21:04 9/11/06:00-9/12/00.00	39	248.5
	39	94-10	55462	1-4	9/8 20:33	22°12.02'N 121°00.92'E	1231	9/12 03:52	22°12.14'N 121°01.21'E	1250	9/10/00:00-9/10/21:04 9/11/06:00-9/12/03.04	42	268

33	40	94-6	55454	1-4	9/9 02:35	22°12.01'N 120°35.08'E	225	9/12 13:04	22°11.92'N 120°35.09'E	226	9/10/00:00-9/10/21:04 9/11/06:00-9/12/06.03	45	287
	41	94-18	57113	1-4	9/9 03:46	22°12.07'N 120°23.39'E	403	9/12 15:26	22°12.03'N 120°23.41'E	405	9/10/00:00-9/10/21:03 9/11/06:00-9/12/06.03	45	287
	42	94-16	55497	1-4	9/9 04:37	22°12.12'N 120°14.55'E	826	9/12 17:24	22°12.11'N 120°14.53'E	829	9/10/03:00-9/10/21:04 9/11/06:00-9/12/06.02	42	268
	43	94-15	55472	1-4	9/9 06:03	22°12.17'N 120°00.14'E	1143	9/12 20:10	22°12.04'N 120°00.09'E	1145	9/10/06:00-9/10/21:00 9/11/06:00-9/12/06.01	39	248.5
	44	94-13	55496	1-4	9/9 07:15	22°12.20'N 119°48.53'E	1537	9/12 22:32	22°12.32'N 119°48.55'E	1550	9/10/09:00-9/10/21:01 9/11/06:00-9/12/06.03	36	229.5
	45	HT-7	46996	1-3	9/9 08:26	22°12.23'N 119°36.87'E	1819	9/13 00:46	22°12.38'N 119°36.98'E	1820	9/10/12:00-9/10/21:01 9/11/06:00-9/12/06.02	33	166
45	46	HT-4		1-3	Not deployed								
	47	HT-5		1-3	Not deployed								
	48	HT-6		1-3	Not deployed								
	49	HT-7		1-3	Not deployed								
	50	HT-8		1-3	Not deployed								
	51	92-7		1-4	Not deployed								
	52	93-4		1-4	Not deployed								
45&47	53	94-7		1-4	Not deployed								
47	54	94-6		1-4	Not deployed								
	55	94-9		1-4	Not deployed								
	56	94-10		1-4	Not deployed								
	57	94-11		1-4	Not deployed								
	58	92-12		1-4	Not deployed								
	59	94-13		1-4	Not deployed								
47&49	60	94-8		1-4	Not deployed								
49	61	94-15		1-4	Not deployed								
	62	94-16		1-4	Not deployed								
	63	94-17		1-4	Not deployed								
	64	94-18		1-4	Not deployed								