ACOUSTIC IMAGING, SEISMIC AND CORING STUDY OF THE WESTERN SOLOMON SEA COLLISION ZONE, HUON GULF PAPUA NEW GUINEA

Don Tiffin'
SOPAC Technical Secretariat

May 1993 *SOPAC Cruise Report 142*

'Prepared from notes by

ELI SILVER
Earth Sciences Department
University of California - Santa Cruz

Prepared for: South Pacific Applied Geoscience Commission (SOPAC)

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

Cruise number MW 92-04 on the American research vessel MOANA WAVE obtained acoustic imagery, multi-channel seismic reflection profiles, seabed samples, and gravity and magnetic data in Huon Gulf and western Solomon Sea, Papua New Guinea during the period 2 March 1992 to 13 April 1992. The cruise was funded by National Science Foundation and led by Dr Eli Silver, Earth Sciences Department, University of California, Santa Cruz campus.

Two major plates of the world, the Pacific Plate and the Indo-Australian Plate, meet along a borderland of trenches, transforms, sub-plates and micro-plates stretching through the Western and Southwest Pacific from Japan to New Zealand and beyond. The western Solomon Sea (Figure 1) is in the borderland area and is the site of a major collision between plates.

A triple junction occurs in the western Solomon Sea where three plates meet. Two of the plates, the Indo-Australian Plate in the south, and the South Bismarck Sea sub-plate in the north, have collided along a suture (Figure 1) marked on the Papua New Guinea mainland by the Ramu-Markham valley, and offshore by a line through the Huon Gulf that follows roughly along the Markham Canyon into deep water (Figure 1). These two plates continue to collide and are closing in a scissors-like action at a collision point in the western Solomon Sea. The third plate, the Solomon Sea Plate, lies east of the collision point between two trenches, the Trobriand Trench along the south side of the plate, and the New Britain Trench on the north side. The present collision point, the fulcrum of the scissors, is marked by the junction of the two trenches. The Solomon Sea Plate is being subducted into the New Britain Trench under the South Bismarck Sea sub-Plate and is also being depressed under the eastward-moving collision point. The Solomon Sea Plate may also be subducting at the Trobriand Trench, but at a much slower rate than in the New Britian Trench.

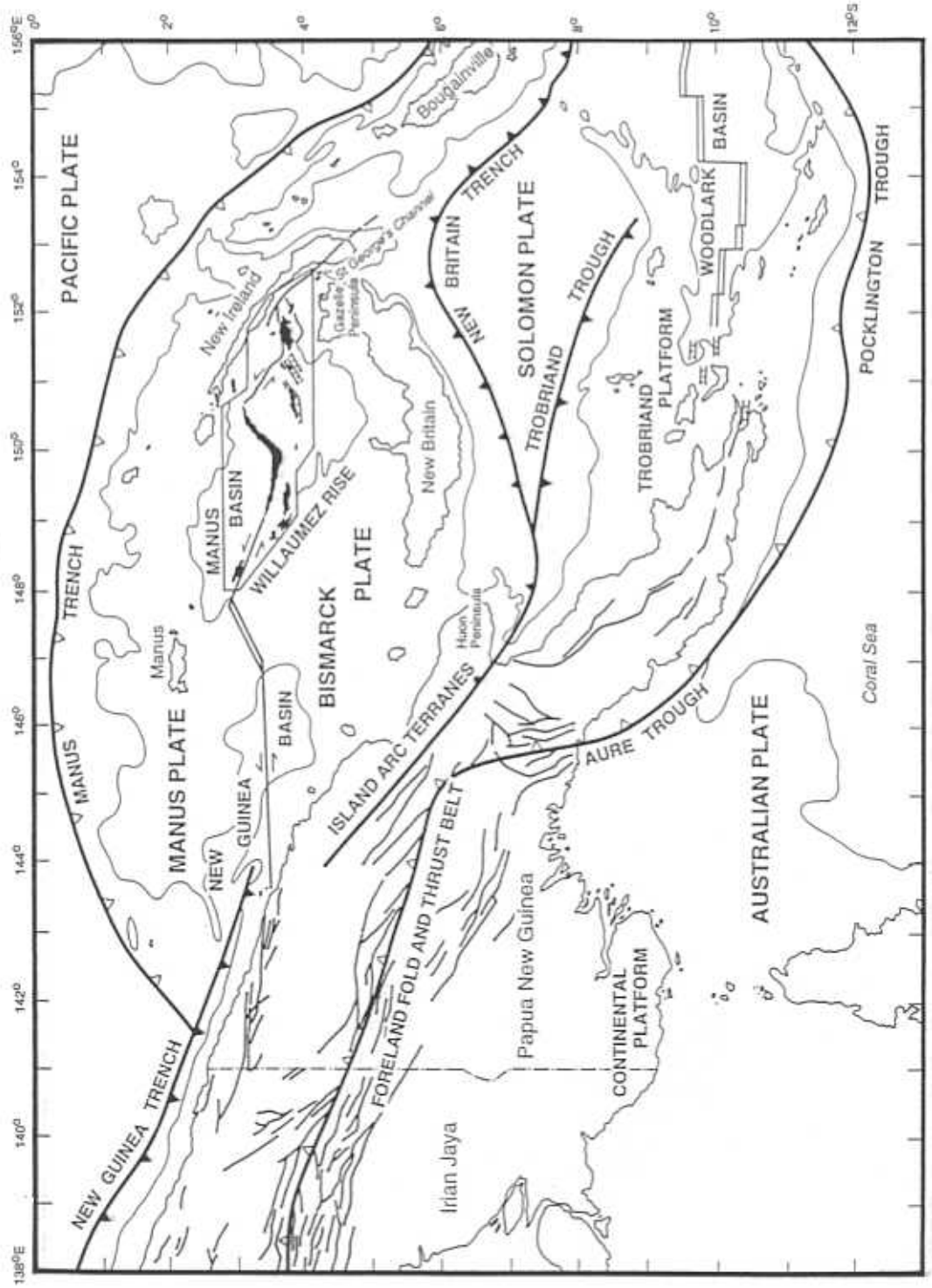

Figure 1. Tectonic setting of the Solomon Sea area (from Taylor, et al, 1991). The *Moana Wave* cruise was in the Huon Gulf and western Solomon Sea.

The purpose of the cruise was to obtain imagery and bathymetry over the western Solomon Sea and the collision area (Figure 2) using the Hawaii institute of Geophysics' wide swath sidescan sonar and bathymetric mapping tool, MRI. The cruise also obtained multi-channel seismic, magnetic and gravity data, and dredge and core samples to investigate the offshore extension of the Finnisterre Terrain on the Huon Peninsula, and associated accretionary units on its southern flank. The objective was to study the active collision processes, the sedimentary environment, and tectonic features of Huon Gulf and the western Solomon Sea.

SHIPBOARD SCIENTIFIC PARTY

Eli Silver	UC Santa Cruz	Chief Scientist
Don Reed	San Jose State Univ.	Go-Chief Scientist
Keith Crook	Australian Nat. Univ.	Research Scientist
John Hughes Clarke	Univ. of New Brunswick	Research Scientist
Lon Abbot	UC Santa Cruz Graduate	Student
Joe Galewsky	UC Santa Cruz Graduate	Student
Keyu Liu	Australian Nat. Univ.	Graduate Student
Greg Whitmore	Australian Nat. Univ.	Graduate Student
Peter Woyengu	University of PNG	Student
Francis Waina	University of PNG	Student
Joel Erickson	HMRG, Univ. of Hawaii	Electronics Engineer
Eric Halter	HMRG, Univ. of Hawaii	Systems Analyst
Dan Johnson	HMRG, Univ. of Hawaii	Data Technician
Steve Tottori	HMRG, Univ. of Hawaii	Electronics Engineer
Tina Mueller	HMRG, Univ. of Hawaii	Data Technician
Sharon Stahl	STAG, Univ. of Hawaii	Systems Analyst
Steve Poulos	STAG, Univ. of Hawaii	Electronics Engineer
Will Herbig	STAG, Univ. of Hawaii	Electronics Tech
Dave Dravatt	STAG, Univ. of Hawaii	Deck/ Seismic Tech

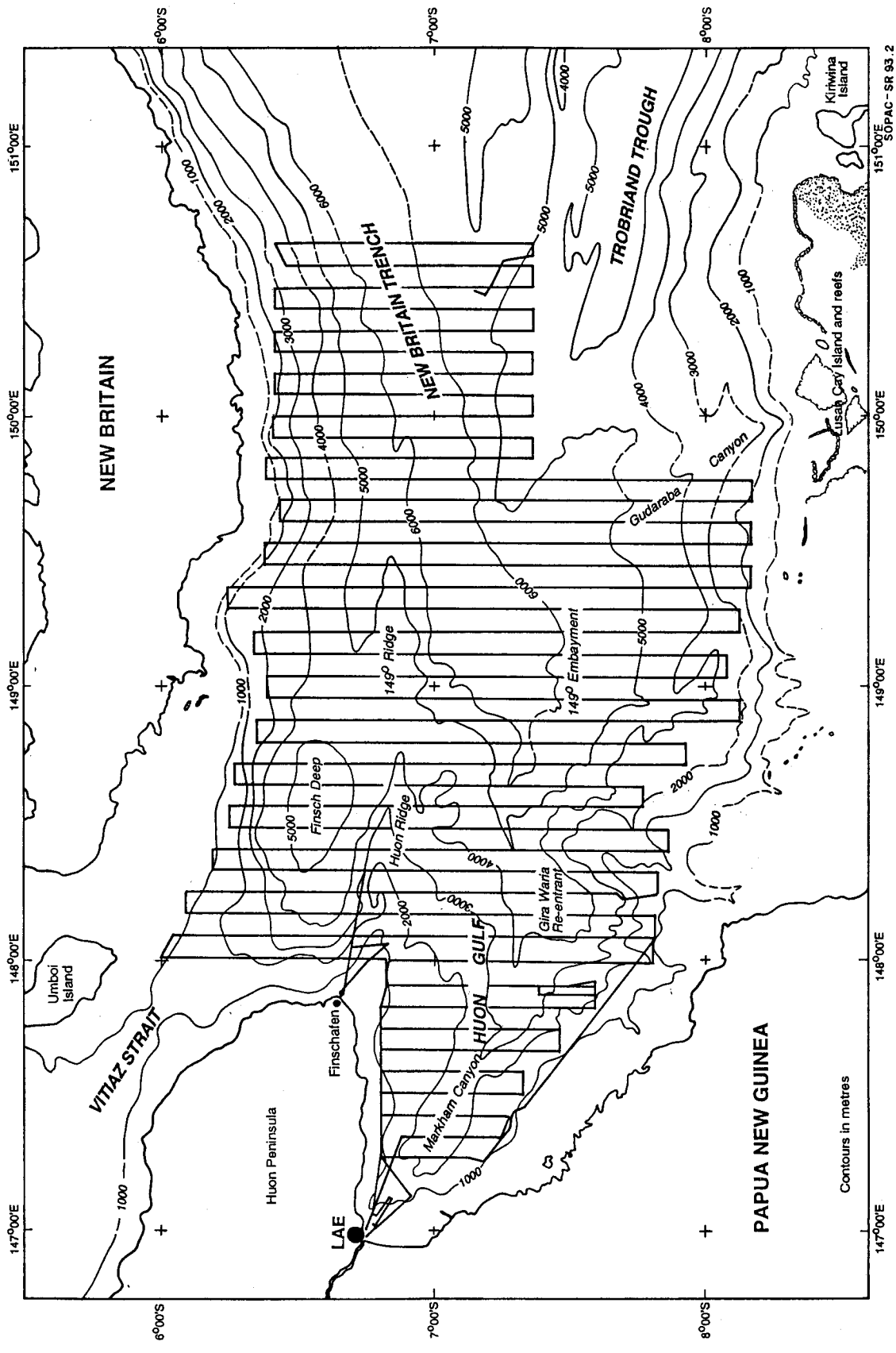

Figure 2. Tracklines of the survey are shown on a bathymetric background. Bathymetry from Davies et al (1987).

ITINERARY

3-5 March	Dockside preparation, Lae, PNG
6 March	Cruise begins
8 March	MRI system down, retrieved for repair. Operating again by 1200 hrs. Seismic system down for repairs 1730 - 2300 hrs.
10 March	MRI system down for repairs, 0030 - 1530 hrs
12 March	MRI fish separated from cable. Recovered and repaired. Data lost from 1415 - 2000 hrs.
13 March	MRI fish lost again: recovered and repaired. Gear retreived 1500 hrs to proceed to Finschhaven to pick up spare parts.
14 March	Launched gear 0300 hrs.
19 March	MR1 shut down for repair 1430 - 2220 hrs
31 March	Commence coring
6 April	Finished coring and dredging. Arrived Lae 1300 hrs.
7 April	Left Lae. Took one dredge haul.
8 April	Recommence MR1 and geophysics until 1530 hrs. Recovered gear and headed for Guam.
13 April 1992	Arrived Guam.

DATA COLLECTION

Figure 2 shows the tracklines in Huon Gulf and the western Solomon Sea. Seismic profiles, magnetics and gravity data were obtained over most of the tracklines. Dredge, coring, and camera stations are not shown. Samples obtained during the cruise are archived at University of California, Santa Cruz.

A preliminary image mosaic was made up on board ship which, with the seismic, magnetic and gravity data, greatly assisted selection of sample sites. A final image mosaic is being constructed by the Hawaii Mapping Research Group at the University of Hawaii.

APPENDIX

DAILY LOG OF EVENTS

by

ELI SILVER
Shipboard

March 3: Took Gravity tie on the pier and at the old airport terminal. That terminal has since burnt down, but the site descriptions were quantitative and allowed us to locate the sites with reasonable confidence.

March 4: All scientific party on the ship. Testing equipment. MR1 not responding properly. Starboard electronics blowing circuits. Sandy, Mark and the other MR1 crew worked until 0130 March 5, at which time they went to bed and asked for the ETD to be delayed. Purchased plane ticket for Sandy to return from Finschafen on March 9. Also purchased plane tickets for Francis and Peter so they can fly home from Finschafen after the scientific work is completed.

March 5. Delayed ETD until 1200, then to 1600 hrs. The crew worked steadily but by early afternoon it became clear that the system would not be ready before dark. Reasoning that even if the system were ready by late evening, the techs would not be at maximum efficiency for initiating the cruise. So ETD was again delayed to 0800 on March 6. Purchased plane ticket for Mark Rognstad to fly back from Finschafen with Sandy on March 9.

March 6. Underway at 0830L. Fire and boat drill right away. Setting up MR1. The MR1 is working well. Some problem with the screen display on the bathymetry, but the data going into the tape

is good. Seismics have been restricted to one gun. First the 120, then the 300. Except for a seal failure, all other problems have been those of electrical breaks in the cable. Scientific party has been instructed in the lab watch.

March 7. System worked fine through the night. Made several crossings of the Markham Canyon, and the structure is clearly that of a major thrust. Much evidence of erosion on either side of the thrust. MR1 has documented the channel and fault structures on screen, and DJ has started processing the MR1 data. At this time the primary MR1 data all look good. Presently plans are to go into Lae on Monday, to let Sandy and Mark off the ship and to pick up the order of spare chips for the MR1. Timing is still uncertain, as we don't want to go in prior to arrival of the shipment. At midday both guns were firing, which greatly improved the signal amplitude. Don discovered that the polarity of channel 2 was switched, and that was corrected after line 6 was completed. John Hughes Clarke has started digitizing topography on the Huon Peninsula adjacent to our work area. The MR1 data will be able to merge with this set. Each crossing of Markham canyon shows good signs of frontal thrusting and low angle north dipping thrusting of the peninsula beneath the Finisterre terrane. Line 7 shows several slope basins. One high on the north slope is about 5 km wide and 1 km thick. The same basin was mapped on the previous line. Bounding this basin on the downslope side is a ridge associated with a magnetic anomaly of over 100 nT. May be Finisterre Volcanics.

March 8. 0230L MR1 stopped transmitting data. Amperage increased to about .34. stbd side was not working. We slowed and pulled in gear. 0500L ETs are still checking system to determine extent of the problem. One of the transmitters has a bad component. MR1 on deck and bad component repaired. Still no understanding of why they go out. 0900 starting to get ready to relaunch. 1200L MR1 working well. Channel 3 of the seismic streamer not recording. Decided to wait until the end of line 9 to repair.
1730 L. Checked cable and decided to swap section 3 out and replace with the last new section. Completed the swap about 1930L. At this point, channels 1, 2, and 3 are working but 4, 5, and 6 are not. Testing at the near end has not revealed the problem, so cable must be flaked out on deck again for further testing. After swapping several sections and checking each with great tediousness, six channels are finally working. (2300L). During the problems with the streamer, the magnetics were turned off and not turned back on for a number of hours. Probably 3-5 hours lost unnecessarily.

March 9. System worked well through the night. Crossings both ways indicated NW-trending faults along the vitiaz strait. Discussed the problem of 1000 mgal discrepency in gravity with Sharon. There appears to be no change in the meter (fortunately), only in the computer. She feels error will be no more than 2-3 mgal, so we will not try to do a tie at the pier, saving much time and expense. Hopefully the discrepency will be minimized later. Finished Line

11 and part of line 12.

March 10. 0030 MR1 down. Same problem as usual, this time including blowout of chips. Almost exactly 2 days since the last shut down. System seems to be on a 2 day cycle. Out of every 2 days about 8 hours are lost. 0150L MR1 and tail buoy on deck. Launched seismics and magnetics to run line 13 (N-S). 0230L Major problem with the electronics in MR1. Short in capacitor circuit, possibly due to faulty transformer. Need to replace circuit board, not just chips as before. Voltage buildup occurred just after watch had recorded normal value (0.28). Nine minutes later they noticed values of 1.4 and called techs who shut down system. Sandy feels that the buildup may have occurred very fast and would not have been helped by continuous watching. It still might have saved the magnitude of damage if not prevented a shutdown. MR1 must be brought on board for repairs in any case. During the southern framing line traffic caused a major disruption in the survey line. We made a good crossing of the Gira and Waria canyons and crossed several submerged pinnacle reefs. Should have good control on the drainage network here. Not clear to what degree structure controls the canyons south of the thrust front.

0700L Finished line 14. Made two crossings of the Markham thrust without MR1 but with the full seismic system. Monitors look like we still have good crossings. Engineers are still trying to trace down the extent of the damage. 0830L Sandy and Mark departed by Zodiak for Lae. Agent has not heard about any shipment of chips. We will use 2 of our last three spare chips for this repair, and

if we don't have the shipment Sandy will chase it down and meet us in Finsch with the spares.

1400L Message from Sandy saying the parts are still in Sydney and he will stay behind to do the leg work of tracking them down and getting them to us.

1530L Launched MR1 heading SE into the gulf. Current level was a bit higher than earlier (.31-.32 vs .27-.28) but the system seems to be working well. Launched airguns, streamer and magnetometer. Turned to run NW parallel and south of the thrust front, mainly to Cross trend of fault bounding the PUB of the Papuan Peninsula. Then turned east to run the framing line along the northern gulf that Keith is interested in. The Starboard array of MR1 is on reduced power in order to save the components from burning up.

2230L MR1 reached high transient values and Keith shut it down. Turned back on with no ill effects. Maintained values of .31 for a few hours, then settled down to more reasonable values of current (.28).

March 11. 0600L System worked fine all night. Watch has been focused on the current readings and screen output constantly. Lower plate in northern gulf of Huon appears to be the surface of a drowned reef system. small outlier blocks interpreted as patch reefs. Interreef channels possible. Curious why we don't see equivalent reefs incorporated beneath the Leron formation.

2200L System has worked well all day. Amps cycle between .27 and .33. Crossed the GW reentrant, Huon ridge, Finsch deep. Probems this morning with channel one. Will cleaned the cable connector on

the southern dogleg and noise has not recurred. Spare chips are either in Lae or on their way. Sandy will meet us in Finschafen on Friday. Seas get somewhat rougher on the northern part of the Solomon Sea as we get blown from the Vitiaz strait.

March 12. 0800L Air gun problems during the night, but at least one gun was firing at all times. Crossings of the Finsch Deep indicate tectonism occurring in that basin, as was known before. 12 sec seismic shooting seems to interfere with MR1 but 11 sec does ok. 1300L Gun problems resolved earlier this am. Noted channel 3 weaker than the others but the signal seems to be there. As the mosaic gets more developed we can start to see patterns developing. The drainages on the south and north sides are fundamentally different. 1415L MR1 power went off. Pulled in cable and saw that the fish had separated. Spent about 3 hours searching. Joel and 2 ABs went out in zodiak to attach a line to it. Joel had to swim onto the fish in order to find the end of the cable. We had finished most of line 18 and will head slowly toward the end of the line while repairs are being made.
2000L MR1, seismics, maggie all in the water. Turned onto dogleg 18d. Will do this line then break off for Finsch. Electronics seem to be working with no problem. The problem earlier was that the weak link broke. Unclear why it should have broken at that particular time. Line 18 ended before the planned end of line but it was well south of the thrust front. In this area the front goes through a bend, similar to where we mapped a bend earlier, based on Davies et al bathymetry.

March 13 0000L Lost the MR1 fish again. Retrieval was straight forward due to the lights. The shear pin again broke. Attempted to correct the problem by substituting a new housing for the pin. Also, moved flight level to 70 m in case the pins were defective. Will construct a new set of pins for use out of Finsch. Crossing of the trench on line 19 showed a sharp thrust front and a narrow zone of restriction for Markham canyon. No Magnetic anomaly associated with the Duboin spur.
1230 L Turned off line toward Finsch. Ran for 2.5 hrs and began pulling in the gear in sloppy seas. Everything came aboard ok, with a few safety loops lost but nothing irreparable. Very careful job by the techs. 1615 L everything aboard and bouncing toward Finsch. Arrived at Finsch about 1830. Sandy came out to the ship by zodiak with the spare parts. Joel repaired the safety eye on MR1 launch and had the engineers make a new release bolt. That was placed in the coupler and we departed Finsch at 2230.

March 14. Launched MR1 about 0300. Run north crossed the Finsch deep again on line 19. Definite signs of faulting on this line in the Deep. No good side scan on the monitor for this crossing, but the margins are EW trending. Faults expected to be NW trending based on previous crossings. MR1 amps running at .31.
2030 L Just crossed the collision zone. Good thrust geometry on the upper plate. Weather has calmed down considerably in the southern part of the Solomon Sea. SO far no clear sign of tectonism on the lower plate, except for the implications for significant vertical

motion of the drowned reef tract to the west.

2200L Have made crossing of the trench and lower part of Trobriand slope. Aside from a small fold on the lowermost slope of the Trobriand, the rest of the slope appears to be undeformed.

March 15 0700L Crossed the Trobriand slope and the trench on line 20. Still not much sign of deformation of the Trobriand side. Several major canyons cut the south slope. Examined the side scan record with DJ who pointed out that after 5 km on either side of the track the noise ramps up to high levels and we lose information especially of the more subtle features. Going to 7 km swaths will get us the high amplitude scatterers but will lose the subtle ones. We may be better off staying with 5 km swaths, 9 km spacing. That will definitely limit how far to the east we can image, but it will assure us of maximum quality data. Minor problem in recording seismics, in which the traces switch during acquisition. This happened just after a change in delay and cycle time. Paused system, changed tape, which cleared up the problem.

2030L Have made a number of crossings of Finsch deep. Eric has most of the data processed. Mosaic shows that the north wall of the Finsch Deep is cut by normal faults in several places.

2230L (12302) Lon changed the delay to 5 sec with a 10 sec rep rate. The Masscomp froze, and Steve has been working for hours trying to get the system up and running again. The shutdown occurred on Line 22 at 6-56s. We decided to keep running and come back later to reshoot the seismics, rather than run circles with the MR1. We can run the seismics in the midst of a coring program.

This region would be a prime one for sampling, because of the GW reentrant and the 149 embayment.

March 16, 1000L Running north on line 23, down the Trobriand slope. Here there is evidence for south dipping reflectors indicating thrusting of the slope. Using a 12 second rep rate. The Mosaic is looking quite spectacular with everything together. Surface drainages and sedimentary processes are prominent on the side scan, whereas faults, except for the large normal faults and major thrust front, are subdued. Need seismics in order to interpret them.
1800L Very impressive set of faults cutting the slope above the Finsch Deep. The south side may be governed mostly by thrusts, possibly backthrusts behind the Markham-New Britain trench system. Minor problems with the guns. About an hour with only one gun firing. Just a few minutes with no guns firing.

March 17 0830L Good crossings of the New Britain trench and Trobriand Trough. On line 24 there is a small ridge in the narrow Solomon Sea slot between the two trenches. It may be an overbank levee, which would be consistent with interpretations of the Moore data. Alternatively it could represent a structural feature.
1345 L Mosaic of Finsch deep reaches 148-45 E. The NW trending fault scarp high on the New Britain slope (about1000m) intersects the E-trending scarp lower down (about 3000 m). Noticed that the mosaic showed differences in reflectivity characteristics between the port and starboard arrays. The port array tends to be grainier, with more speckle, whereas the starboard is smoother. This

difference produces different bands of smooth vs speckle through the mosaic. Post cruise processing may be able to normalize these differences.

1820L Lost Magnetometer for about 2 hours. Coil was loose as was back plate, which let in water. New parts replaced the old and now the data are quite clean. We've been fighting noisy data for several days. Crossings of the Trobriand Trough are showing deformation far up the slope. That negates my earlier idea that the deformation was confined to a narrow zone, making it easy to override. That leaves us with the problem unsolved. Two possibilities include: 1) the Trobriand deformation front: may have been offset along a transform or s-shaped bend. The western part of the system would have been overriden by the Huon Peninsula, whereas the eastern part is still visible. The transform segment marks the position of the triple junction. 2) the Trobriand margin does not undergo a shift but rather is buried as a result of greatly increased slope sedimentation, which buries the old deformation structures. The first idea can be tested with the present data set, because if true we should see an abrupt change in the structure of the Trobriand slope. The second idea should be visible with seismics, when we compare the parallel lines across the slope.

March 18 0710L Have made several long crossings of the Trobriand side. Each shows significant deformation high on the slope. Have' now mosaic to beyond the triple junction. Surface sedimentation overwhelms the structural signature of the Trobriand thrusts.

Gravity was down for about an hour last night before it was noticed to be off. Magnetics seem to be working cleanly, after several hours of almost no change, just after the new fish was installed, 1825L System has been working well. The hour of lost gravity could be a problem and will be helped by taking a still reading in Dregger Harbor at Finschafen. MR1 crew now working on 3 mosaics. Keith has asked them for one and I asked that Peter and Francis have one to take back with them to UPNG. Decided that they will plot out side scan and bathymetry data as well as finished navigation and Francis and Peter can work on making a mosaic during the last week. They can take turns doing a mosaic and working on deck with the cores. That will solve the first part of our problem of getting the data to them. Seismics appear to be penetrating the full thickness of the sediment in the Solomon Sea. At this rate, we should get fully into the pelagics and out of the highly sedimented parts. Magnetics had a rocky start after the new fish was installed, but with some careful massaging Sharon had it looking as though it were real. Certainly is much cleaner than before. Lost an hour or two of two-gun source this morning as a leak was repaired in the Starboard gun.

March 19 0815L On the northern part of line 26. Generally strata in the Solomon Sea basin dip north toward the New Britain trench, though local reversals near the Trobriand can occur, for example on line 26. The last two crossings of the Trobriand slope encountered a wide sedimentary basin on the slope (Gudaraba basin), which may be fed by the local volcanoes (Victory and Lamington).

As we move eastward, the depth of penetration of seismics decreases (as the sediment thickness decreases), meaning we probably will not have to shoot at a greater interval than 12 seconds. Had problems with 13 second shooting and 13 second MR1 shooting, with seismic trace migrating across the side scan image. The reason was that MR1 is not timed exactly at 13 seconds.

1045L After almost two weeks of suffering the garbage coming out of the new EPC recorder, we decided to plug in another recorder for the seismic record.

1530 Shut down seismics, magnetics, and MR1 at about 1430 in order to investigate excessive noise on the port side of MR1. All gear on deck at 1525. We had noticed an increase in the noisiness of the side scan record on the port side for days. Joel and Eric felt there might be something loose on the instrument. We had just started line 28, so it will be easy to make a loop and come back down the line after the problem is dealt with.

1550 L the problem seemed to be loose bolts holding the housing on the fish. Techs tightened everything down and are now relaunching the MR1.

2220L MR1, Seismics and magnetometer in the water and working. Start of Line 28. Loss of about 8 hours. Just as MR1 was about to be launched at 1550 the techs noticed that the cable had breaks near the connector. They took about 6 hours to replace the connector, which clearly would have caused significant problems later on. Looks like they did an excellent job in very good time.

March 20 0915L System worked very well through the night. Good

crossing of New Britain wedge, Solomon Sea portion getting wider, due to the bending of the deformation front, Keith pointed out what look like very small faults cutting the sediments in the 149 embayment, based on the 3.5 kHz records. The throws are much too small to resolve with seismic, and they may be a surficial phenomenon.

1130L Sent a message to Wilkens earlier asking about the request for an extra day.

2115L Crossing the 149 embayment. Possible mud volcano on the lowermost Trobriand slope of line 29. MR1 showing almost no backscatter on the monitors and is not able to determine bathymetry, though the techs assure us that all the data are on the tapes and they should be recoverable. This has been the case the whole trip. The poor response of the monitor data makes real time interpretation quite difficult. There is definitely a major step in the thrust front on the New Britain side, stepping north to the east.

March 21 0845L Extension of Finsch Deep to east of 149E. Irregular bottom characteristics, no indication of sediment deposition of any significance.

1000L Crossed south facing fault scarp on the upper New Britain slope. May have a NW trend, as seen on the side scan.

1800L Crossing of the New Britain trench showed a steep slope to the basin, not associated with a magnetic anomaly, leading upslope to solitary peaked ridge, which then continued upslope normally.

John has examined the MR1 data at high magnification and discovered what looks like 60 Hz noise throughout the record. Not sure what

exactly is the cause, but we will devote the dogleg in 6 hours to testing.

March 22 0645L Stopped shooting A/G at 0043-0123L on the dogleg, Line 30d, to test for the source of noise in the MR1. Will have to wait until John gets up and can work with the data for awhile. MR1 stopped transmitting at about 0500L, for about 20 minutes. Watch didn't catch the stoppage until the next log check. Have crossed the Trobriand slope again. Wide slope basin (Gudaraba basin) on lower slope, thick trench sediment at base of slope. Surface of sediment slopes away from slope, indicating that on many of these lines sedimentation is more rapid than tectonic tilting. The Ewing is about to deploy their MCS system and start work in the Woodlark basin. Need to contact Mutter and recommend they not cross the platform until we are finished. (Thinking about this later, it seems that they will not be closer than 100 km from us at best, giving frequencies much lower than we accept for the seismics).
1000L Eric has plotted an extra copy of the side scan data and Sharon has made extra copies of the completed track charts, each earmarked for Francis and Peter to make a copy of the mosaic to take back to UPNG with them. This afternoon DJ or Tina will show them how to get started on annotating the data strips and later how to do a mosaic. They will also have bathymetry strips that can be mosaicked. Seismic data will have to wait.
1800L Another full crossing of the New Britain slope; similar to what what seen on Line 30.
2115L Contact between the apron and the upper part of the arc

creates a strong reflection on the MR1 image. Abundant drainages adorn the apron. It is helpful to go as far onshore as possible, within the limitations of water depth. Bathymetry shows up clearly in the shallower depths - the system really shines. The lapse this morning at the base of the Trobriand slope is a real gap in data.

March 23 1620L System has been working very well for days. Discovered two huge jumps in the front of the New Britain trench, one just west of the junction and one probably associated with it. The Trobriand trough frontal thrust is not entirely clear at that location, but it comes into the junction along a NW trend and heads into the NW trending step in the NB thrust front.
2200L Made a major discovery when we put together three of the mosaics. The New Britain trench arcs around to the north until it intersects an E-W segment that appears to represent the main trend of the trench off to the east. West of the intersection that E-W trend continues along the 149 ridge and up onto the Huon Ridge. That same structure probably continues along the Huon peninsula and Finisterre range as the front of the Finisterre volcanics, marked in the Erap and Leron canyons by the Wongat thrust. The arcuate southern bend of the thrust front west of the intersection is due to the very young accretion of 149 embayment sediment.

March 24 0845L Midway is having major disk read problems. Sharon and Steve have spent hours trying to clean the disk, but most of the repair attempts are failures. Midway controls most of the logging, the calcomp plotter, and has most of the disk storage on

board, Going down the steep New Britain slope. Have been crossing high amplitude fault reflectors high on the slope, which look in character and orientation like extensional scarps.
1800L Midway still down, refuses to allow format of partition. May have to reformat the whole disk. The central ridge of the Solomon Sea is very prominent here. Both this (line 34) and the last crossing showed outcrop of basalt.

March 25 0750L Part of the Midway disk is being salvaged, isolating the central corrupted part. They will try to run the Calcomp and mail from Midway, and some of the logging. But it's not done yet. After much discussion we have decided to focus on the northern area. No update on the mosaic for the last two days, due to the crash of Midway.
1200L Midway still not up, and problems are not going away. Will probably have to rely on Maro. Decided to run two more long lines across the Trobriand, then focus on New Britain. That should still get us past 150 – 40, will cover most of Gudaraba canyon, and assuage my worries of breaking off the full survey too early.

March 26 0720L The Gudaraba basin has just about ended, and a major basin farther upslope is now in evidence. The central ridge of the Solomon Sea is now very prominent, with much outcrop, leading to the suggestion of dredging for another try at possible dating. Seismics are showing good stratigraphy across the Solomon Sea.
0910L Steve has installed one of the MR1 hard disks on Midway. Seems to be working. 1130L Still trying to install.

2200L Mosaic of NE slope shows upper slope drainage and possible fault patterns, middle and lower slope mottling but little structure. Frontal thrust is clear, but back side of 149 ridge is not.

March 27 0800L Last two crossings of New Britain slope indicate that accretion of the trench turbidites forms a frontal high, behind which is a large plateau with seismic character similar to unsedimented part of Finsch Deep. No clear structural contrast between the plateau and the frontal deformed material, nor with the slope above the plateau. However, higher up on the slope we can see a change in slope and structure between the lower deformed material and the upper volcanic and volcaniclastic arc debris.
1650L With each line up the New Britain side that division of lowermost accreted sediment, mid-slope older accretion, and upper slope arc apron become more clear. These units are mappable, even on seismics alone, and should be usable for understanding the evolution of the margin. Rain this morning wiped out the MRI record for about an hour or so. John will see whether it can be filtered and recovered somewhat. New software arrived that solved the bottom detect problem, allowing us to get decent real-time images of side scan and bathymetry in deep water. Email from Julie Morris indicates the kind of information needed for Be-10 studies, On the mosaic there is a long, minor channel that connects the east end of the 149 embayment with this central part of the NB trench: Channel is quite straight and seems to end at a submarine canyon down the NB trench slope. Very curious.

March 28 0710L Mosaic of the central Solomon Sea ridges shows a very regular pattern, suggestive of a spreading pattern. Last crossing of NB slope (Line 40 at 150) was coincident with the location of line 6, and showed the buried graben, clearly a feature of the original crust that was filled in with early turbidites. A good candidate for subduction of sediment, often suggested by various people. If common in the Solomon Sea, a possible source of Be-10 material:
1800L Made overlay interpretations of the Huon Gulf and 149 mosaics. An interesting story in the distribution of sediment in the basin. Crossed the Line 6 graben twice. The following line did not and presented a very thin sediment layer to the thrust front. At this point the structure of the lower slope changed, almost eliminating the 149 ridge we have been following forever.

March 29 0900L Crossing of NB trench on line 43 - very thin incoming sediment, low taper accretionary wedge. Hard to see changes along the profile. This does not support the Honza subduction erosion idea.

March 30 0745L MR1 Openwindows crashed at 0703. Down for about 20 minutes while system was rebooted. Crash came just at the base of the slope in Line 46, unfortunately. Scientifically there is no need to go back to reimage this section, though asthetically it will be a loss. These last few crossings have had no trench turbidites, only pelagics. Slope has been quite smooth, though highly

diffractive internally.

March 31 0630L End line 48, pull in seismics and magnetics, then commenced noise test on the MR1 on the way to coring station 1. The last 3 lines were clearly in the pelagic realm with no turbidites in the trench. The (probable) accretionary wedge has become narrower as we progressed eastward.

1430L Launched first Piston Core at site 1. Some delay in setting up due to rusty fixtures, etc, but launch went well. Water depth 5990 m and wire out was 6210 m, an increase of 1.037 times, which may be multiplied by the 3.5 kHz water depth to estimate wire out at these depths. The Mathews Tables correction indicates a depth of 6060 m, so the difference must be due to wire angle. That angle turns out to be 12.6 degrees, not insignificant. The pullout tension was 4000 pounds greater than the pretrip tension, indicating thick penetration of mud. There was some worry about the speed that the winch would be able to go, because of the need for keeping in extra low gear. However, we maintained a speed of 55 m/min all the way down, which is as fast as you care to go with a loaded piston core. Coming up we started at 25 m/min.

Got a message from John Mutter on the Ewing. They had a nasty time with the reefs (not a surprise), but are now working well with 220 channels (down I think from 240). John talked about joining our lines with his work coming up. That will not work because we have finished the geophysical aspects of the program; it would have been good to work out a 2-ship operation beforehand.

2030L Core on board with about 5 feet of brown clay, very sticky

on the bottom and fluid at the top. Appears to be a thin, watery layer above much more sticky mud a short distance below the surface. Suggests a slow sedimentation rate, as would be expected from the fact that only about 300 m of sediment overlie ocean crust of probably middle Tertiary age. Have just launched core #2 at 1930. Engineers have spent the last hour working on the meter wheel.

April 1 0730L core 2 went down and came up empty. Thought that maybe there was a problem with the piston riding up the core barrel on the way down, so have secured it in place with wire. Total line out was over 7000 m. Core 3 went down in the same spot.
1030L Core 3 on deck. Sand in catcher, with 2 m of mud on the barrel. The core was 1.5 m long, which is good for sandy material. It looks like the problem was that piston was riding up the barrel during descent.
1330L Core 4 over the side. Launching operations getting slicker each time. Checked out the free-fall grabs; need some repair before we use them.
1430L Core 4 on bottom. No extra tension on pullout, indicating little or no penetration. Checking the 3.5 kHz record indicates alternating penetration and no penetration as the ship drifted slowly at about the same depth. Site of impact had no subbottom penetration. 1600L Core 4 on deck. Got 1.1 m of sand, olive grey color. Looks to be fine sand. Explains the low pullout tension.'
1900L Core 5 overboard. 2340 L Core 5 on deck, 50 cm of mud.
April 2 0800L Core 6 on deck with 2 m of mud. That is the last New

Britain trench core, all of which were a success. Underway for Station 6, the Oro Canyon site.

1640L Recovered catcher sample of very stiff mud, hard to extract from the catcher. No Core.

April 3 0800L Launched 2 free fall grab samplers last night. Waited until 3 hours past their rated round trip time, but with no luck. Neither returned to the surface (in that time). Started the 10 hour seismic run to fill in the data lost at the triple junction with streamer problems. Channel 1 not working, despite several hours of work to get it going. The problem was that someone in the lab had kicked a switch under the main bench that changed the gain on channel 1, so most of the seismic Line was run with 6 channels.

1545L Seismic off and gear onboard. Begin turn to camera station 1. The station will cross the Markham canyon and the NB thrust front. Unclear from the seismic diffractions whether there will be any Trobriand influence here.

1700L Camera over the side. There is about a one knot current, so we started 1 mile east of the preferred spot.

2215L Camera run finished. Ship made it to 7-15.0. Did not Climb up onto the New Britain slope, which must indicate a radical structural change between our lines and not hinted at on the MR1 records.

April 4 0930L Binandere core down at 0330 and up at 0630. 1.5m long with interesting sedimentary structures within it. Now we are launching the MR1 for the 24 hour experiment.

April 5 1000L Nearly finished with a very successful 24 hour MR1 experiment. Data look quite clean, real time bathymetry and side scan is very clear. The improvement in signal to noise has been an important factor, but the depth s also important. 3 km does better than 6 km. Have laid out new core sites, based on the results of the MR1 survey. Time looks good. Camera run two days ago gave minimal results, due to the strong currents and great difficulty in keeping the ship speed at one knot and direction due north.

April 6 0900L Took four successful cores in the detailed MR1 area yesterday, then moved to the Huon Gulf dredge site. Target was front of what we interpreted as a widespread drowned reef tract. Dredge site was at 2000 m, on a cliff 75 m high. Retrieved 14 pieces of rock, all but one coral. The one was a mudstone fragment. We will attempt to date the coral with U-Th as well as with benthic foraminifera.
1800L Went into Lae at about 1300. Joe, Peter and Francis departed.

April 7 0630L Took dredge RD2, over at 1930 April 6, on deck 0000 April 7. The chain bag was full of Finisterre volcanics, with less than 10% of Song River Calcarenite. The haul is just what would be expected from the outcrops along the eastern side of the Huon peninsula. The dredge started near the base of the escarpment, with a maximum of 1960 m of wire out. First bites were in about 1500 m of water. Bites and nibbles continued to about 1100 m of wire out. The ship made it to the top of the scarp.

After deck was cleaned, the ship headed for 7-05, 148-05 to launch the MR1, seismics and magnetics. Underway at about 0330.
1000L Crossed the location of the mapped N-S magnetic anomaly an hour ago. No sign of an anomaly along this line. Rechecked the tuning and found it to be off, which cleaned up the signal. could that have totally attenuated an anomaly? If anything the signal was decreasing through this zone. Rechecked the original data along the N-S line and found it to be clean. Without the N-S line the contours are more well-behaved. The next step is to ask Ripper for records of stationary magnetics and correct for diurnal variation.
2000L Starboard gun off for several hours, but record looks to be clean. Stbd gun on at about 2230, but still having problems. So it was taken out for good.

April 8 0043L Stopped logging seismics. Fulled in air guns and streamer. Continued at 9 - 10 kts toward the Huon coast towing MR1 and magnetometer.
0600L turned north along the Huon coast into the coastal survey.
0745L Steaming along the Huon coast. Excellent view of the Huon Terraces. As we steamed by Finschafen we crossed a NW-trending straight reflector, probably a fault from the Huon.
1800L Finished the coastal survey about noon and headed north. Did some testing on the MR1, including increasing power to 3/4, increasing pulse with to 10 ms, increasing listening time to 20 sec. The MR1 (and magnetometer) was shut down at about 1537L and hauled aboard. Presently we are steaming full speed for Guam.