**REVISION NOTICE TABLE**

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| **DATE** | **DESCRIPTION OF REVISION** |
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**PROCESSING NOTES**

Cruise: 1981-77

Agency: OSAP

Location: Eastern Pacific

Project: Hudson 81

Party Chief: Wong C.S.

Platform: Hudson

Date: 9 April 1981 – 10 May 1981

Processed by: Germaine Gatien Data Transcribed by: Danielle Caleb

Date of Processing: 28 June 2017 – 4 August 2017

Number of original XBT casts: 163 (Partially processed but not to be archived as of July 2017)

Number of bottle casts processed: 27

**SUMMARY**

These data come from a leg of the Hudson 81 trip around North America. The data were collected between Costa Rica and Saanich Inlet. None of these data were in the OSD Data Archive, but there were many paper records. Those records were digitized with the information saved in spreadsheets as follows:

* Hudson 81-003 Chemistry.xlsx – From paper computer output in file 81-003 Hudson, from filing room #1246 at IOS.
* Hudson 81-003 Log book.xlsx – Original paper log book, from filing room #1246 at IOS.
* Hudson 81-003 XBT chart.xlsx – Original XBT paper chart, from filing room #1246 at IOS.

No CTD data were found though the log indicates such data were collected. There is no record of the instrument used but it was likely a Guildline CTD.

For the bottle files there are two depth channels: Depth:Nominal and Depth:Corrected. There are not always entries for the latter, so Depth:Nominal is listed first. Depth:Corrected values are based on reversing thermometer data.

The XBT data were processed but the depths are clearly wrong. Dividing depths by 2.4 brought values into better correspondence with the bottle data, but no convincing explanation could be found for such an error. The data were not considered suitable for the archive but are available upon request.

**PROCESSING SUMMARY**

* + - * 1. **Transcription**

The data for this cruise were not in the OSD data archive or at MEDS, and no digital records could be found. Spreadsheets were prepared by transcribing data found on paper (computer output) in storage at IOS.

* + - * 1. **Preliminary Checks**

There were many documents available including a cruise plan and cruise report. There were 44 CTD stations, 30 hydrocasts and XBTs every 4 hours and underway sampling using a thermosalinograph. Only the Hydrocast and XBT data were found on paper records. These were transcribed to spreadsheet format by Danielle Caleb. (See Hudson 81-003 XBT chart.xlsx.)

* + - * 1. **XBT File Processing**

The XBT spreadsheet contained date, time, depth, temperature and usually, but not always, positions.

The spreadsheet was simplified and saved as 1981-77-XBT.csv.

Data from the XBT log were added to that file and saved as 1981-77-xbt.xlsx. The log information was lined up to match the XBT casts.

The following data quality definitions were applied as they were found for other XBT data.

Data quality is expressed with the following flags

 0 = not checked

 1 = appears to be good

 2 = inconsistent with climatology

 3 = appears to be doubtful

 4 = appears to be wrong

 5 = value was changed, see the history record

There are comments on quality for most casts and some data were removed that had the comment that data at that level were bad. There are a few cases where data remain for part of the cast where quality was thought to be poor. All data with no comments about poor or bad quality were given flag 1 “appears to be good”. A few values were flagged 3 or 4.

Next the spreadsheet data were sorted on date and depth so that the blanks and the many header column entries could be removed.

The time formats were not compatible with conversion to IOS header files, so the spreadsheeet was opened in Ultraedit to insert a colon between hours and minutes. Every time the spreadsheet is edited it is necessary to set the format for the time to HH:MM:SS.

The next problem is getting latitude and longitude into a proper format. That was done by using concatenate to get entries in format 31 47.81000 N ! (deg min). There was then a problem setting up the conversion routine properly so that those positions got entered in the headers.

As expected there is a problem with event numbers since some casts had an “a” or “b” as part of their names due to multiple casts with the same consecutive number. To avoid this problem, a leading 8 was used for the “a” casts and a leading 9 for the “b”casts.

A few changes were made:

1. No data.

2. There were no positions in any of the files or the XBT log, but there was one in the Bridge Log, so that was added.

3. Bad XBT. Entry removed.

107-112. – There are 2 or 3 casts with the same consecutive numbers, ex. 107 and 107a. Leading 8 used for “a” casts.

109. Position in XBT log is clearly wrong and disagrees with Bridge Log. The latter values were entered.

109a/8109 – position not certain but if 29degN is changed to 31deg N and 114degW is changed to 117deg W position is reasonable. Minutes look reasonable, as the ship was underway for 30 minutes after XBT109.

130. Bad – no data – removed from spreadsheet.

133. Only a surface value found.

152. Two data sets for this cast at same time – values are different. The second set had the temperature values from consecutive #153, so those entries were removed.

159/160. There was a cast between these two consecutive numbers with only the XBT ID entered. Consecutive number was changed to 8159 but it is not at the same site as 159.

167. Two sets of data listed – same time, different surface value – think 1st set had been edited, that one was selected.

A track plot was produced and turned up many problems that were gradually resolved. Event numbers were chosen to match the last 3 digits to avoid the problem of leading 8s and 9s. A few format errors were fixed. A track plot was added to the end of this report.

Next temperature profile plots were examined. Outliers found included a few cases where typos were made in transcription and others were due to problems in preparing the final spreadsheet. A few that are seen in the original records were investigated and where available the chemistry records were examined to confirm if unusual profiles are reliable. This comparison showed that there is a great discrepancy between the hydro cast and XBT temperatures, even in casts where the shape of the profiles were reasonable. Taken with the fact that the pressures look wrong in Juan de Fuca Strait suggests that the XBT depths are wrong.

Section plots were found with station names so that maximum depth could be estimated for those shallower than 1000m. Unfortunately, due to steep slopes and some difference in time between casts, this is not a very good comparison, and we have no way of knowing how close the XBT got to the bottom since they appear to have a maximum range of 750m. For station 24 the plot and bridge log and bottle file suggest that the maximum depth is about 100m but the XBT goes to 750m. For station 51 the XBT went to 750 but data were considered bad below 250m. The section plot, bottle file and bridge log suggest that the bottom was at about 570m. For station 72 the bridge log shows a depth of about 360 while the bottle file went to 290m and the XBT went to 750m.

Next, the depths were recorded for particular temperatures as seen in the hydro files and XBT traces, to see if that could lead to a clear relationship. Four stations were chosen that had both bottle and XBT data; of those, 2 had XBT casts 2 hours before and a second one 2 hours after the hydro cast. There was a lot of scatter above 10m because the waters were quite well-mixed and small differences in temperature lead to large differences in depth. So data above 10m were excluded. Those 6 comparisons produced a consistent relationship with the XBT depths reading about 2.4 times the hydro cast depths. This is consistent with the XBT casts being too deep in Juan de Fuca Strait and out of line with the section drawings found for the southern part of the cruise. When the depth was recalibrated by dividing by 2.4, most of the data from Juan de Fuca Strait falls into the local climatology. When data above 20m were excluded the result was virtually the same as when only data above 10m were excluded.

At this point advice was sought to explain the depth error. Dr. Humfrey Melling pointed out that since a continuous analog chart was used to record the data, there could have been an error in setting the roller speed. Humfrey felt that 2.4 might be the fall speed of the XBT. After adjusting depths by dividing by 2.4 quality comments that refer to particular depths had to be adjusted as well.

Advice was sought from the wider oceanographic community by Mathieu Ouellet. Franco Reseghetti, an Italian expert in strip chart recorders and settings, put in considerable effort to try to explain the results. No reasonable explanation was uncovered. Time constraints led to a decision to abandon the research on this issue, but the records will be kept in case someone wants to dig into this in future.

Next dates were checked since there are discrepancies between bridge logs (local time), hydro files (said to be GMT) and XBT times (said to be GMT). The XBT Julian dates are correct but the header dates are a day out, so ADD TIME CHANNEL was run to subtract 24 hours from the header times.

Next REMOVE was used to remove the Date and Time channels, including the Julian date.

HEADEDIT was run to fix formats and add comments to the headers. These files have extensions XBT.

In order to have a processed data set with the original depths, CALIBRATE was used to multiply depths by 2.4; those files have extensions XBTORIG.

A header check was run and a few errors were found in positions. These were corrected in the spreadsheet and then all steps from the conversion to HEAD EDIT were repeated.

The XBT files with depths divided by 2.4 have extensions XBT.

CALIBRATE was used to multiply the depths in the XBT files by 2.4 so we have a set with the values as recorded originally. The XBT files using the data as transcribed have extensions XBTORIG.

* + - * 1. **BOTTLE FILE PREPARATION**

There were hydro casts in the southern section of the cruise.

File Hudson 81-003 Chemistry.xlsx was saved as a CSV file, simplified by removing unneeded rows and fixing the time and positions formats.

In the course of processing XBT files an error was found in the latitude of station 21 so that was fixed.

The spreadsheet was converted to files with IOS Header format. This step had to be repeated many times to remove errors in positions, formats and pad values. The date and time were converted as columns rather than directly to header entries.

CLEAN was run to add start time to the headers. This also adds End Time which is inappropriate so it will be removed later. There were some empty channels, so those were removed as well.

REMOVE was used to remove the DATE and TIME.

SORT was used to put files in order of increasing depth.

HEAD EDIT was used to add units and remove the ZERO TIME and END TIME.

T-S plots were produced and turned up a few bad values that were replaced with pad values:

Stn 8: Salinity sample at 300m out of line and note in analysis log that the cap was loose and there were salt crystals on neck of bottle.

Stn 20: 400m and 500 little out of line but there may be interleaving. Complex T-S. Left unchanged.

Stn 23: Bottom bottle. The temperature was way out of line and the Depth:Corrected is missing so the analysts must have recognized that the temperature reading was bad.

Stn 24: Bottom bottle. The temperature was way out of line and the Depth:Corrected is missing so the analysts must have recognized that the temperature reading was bad.

Stn 35: An obvious bad entry for surface salinity for station 35. The value was changed from 37.670 to 33.670.

Stn 35: All samples from 200m look out of line including temperature – obvious misfire.

Stn 36: 1200m – Bottles closed late or leaky bottle; samples way out of line in profile, temperature ok

Stn 62: 4000m – Bottles closed late or leaky bottle; samples way out of line in profile, temperature ok

Stn 67: A typo in Depth:Nominal was fixed – the reversing thermometer confirms bottle fired at 980m.

Plots were then made of individual channels. All temperature and salinity data fell within the climatology, which was only available for the last 8 stations. The salinity at 250m in cast 8 is an outlier, as are all the other bottle values. It looks like this bottle actually closed at about 25m, so all bottle values were padded. Cast 30 has an odd profile, but there is no obvious bottle that seems wrong.

