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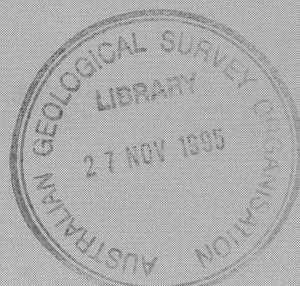
OPERATIONAL REPORT FOR THE 1995 SEISMIC REFRACTION, WIDE-ANGLE REFLECTION AND TOMOGRAPHY SURVEY OF TASMANIA

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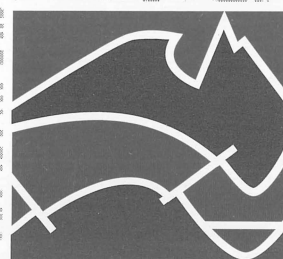
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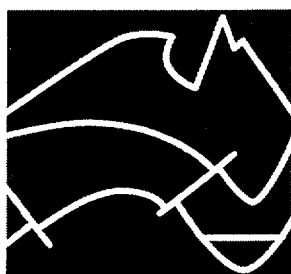
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O R G A N I S A T I O N

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E.C. Chudyk, R. Bracewell and C.D.N. Collins

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DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP

Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Neil Williams

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SUMMARY

During reflection profiling by AGSO's R/V *Rig Seismic* on its 1995 1758 km circumnavigation research cruise of Tasmania, thirty-three portable AGSO seismic recording systems and six University of Tasmania Observatory fixed stations operated continuously. These stations recorded seismic arrivals from the ship's air-guns, providing wide-angle and refraction data with a range of distances and azimuths.

The arrivals have travel paths which pass through the major tectonic elements of Tasmania, and penetrate to below the crust-mantle boundary. They form a substantial new data set for imaging the detailed two-dimensional structure (when combined with the reflection profiles), and the regional three-dimensional structure of the State using tomographic techniques.

INTRODUCTION

This Record documents the field operations of the long-offset seismic component of the TASGO project. It lists all the principal facts necessary to process the data. After processing, the data will be archived within the Australian Geological Survey Organisation's (AGSO) Seismic Refraction Data Base.

The TASGO project was established in 1994 by AGSO and the Tasmanian Geological Survey as part of the National Geoscience Mapping Accord with the aim of understanding the geological controls on Tasmania's geology at depth and how its mineral and petroleum systems fit into this framework. TASGO is a multidisciplinary study in which a variety of geological and geophysical techniques have been applied throughout Tasmania. One objective of TASGO is to map the three-dimensional structure of the island down to the crust-mantle boundary using seismic and potential field methods.

The seismic component of the TASGO project was completed during March-April 1995. There were three components of the seismic study: a series of marine deep reflection profiles which encircle the entire island (Hill & Yeates, 1995; Hill and others, 1995); onshore deep reflection profiles in three key locations (Barton and others, 1995); and long-offset recording on a network of stations to provide refraction, wide-angle reflection and tomographic data.

GEOLOGICAL BACKGROUND

A summary of the geological background to the TASGO project is given in Hill and Yeates (1995). They also provide a summary of previous geophysical and geological studies conducted offshore in the Tasmanian region. A general summary of Tasmanian geology is provided by Williams (1989).

REFRACTION, WIDE-ANGLE REFLECTION AND TOMOGRAPHY

AGSO has recorded many deep (>16 s TWT) seismic reflection profiles onshore and offshore in a variety of geological environments. The profiles generally show excellent structural detail in the sedimentary or upper crustal section and, in some areas, good reflections down to the crust-mantle boundary. However, in common with reflection profiles world-wide, the deep basement, mid- to deep crust and crust-mantle boundaries are in many places poorly defined, if at all. Moreover, without additional information which relates directly to rock type, such as seismic velocity, the interpretation of many deep reflection boundaries remains speculative. The seismic velocity is also essential to convert the reflection boundaries to depth. Such primary parameters as total thickness of the sedimentary section, variation of crustal thickness, and the type of lithology represented by the deep reflection images are crucial to an understanding of the tectonic evolution of Tasmania.

The reflection method cannot give reliable velocities at depths below a few kilometres. This is

primarily because of the relatively short length of the recording spread compared to the depths of the boundaries, the lack of coherent reflectors within basement, and the low energy of vertical reflections from deep boundaries. These limitations can be overcome by recording out to large distances (or 'offsets') from the shots with portable recording systems. The reflected energy increases as the angle of incidence on the boundary increases at large distances, and these wide-angle reflections are generally more coherent at the lower frequencies recorded by portable recorders. Also, at sufficiently large distances, refracted energy is recorded which has travelled within the crustal layers providing a direct measure of the seismic velocity within the layers.

During the offshore reflection profiling by AGSO's *Rig Seismic* (Hill and others, 1995) portable seismic recording stations were deployed throughout the State to record the seismic energy from the ship's air-guns. Most stations were operational during the entire period of the survey and potentially recorded arrivals from all the offshore traverses, thus providing wide-angle and refraction data with a range of distances and azimuths. These arrivals have travel paths which pass through most of the major geological elements of Tasmania, and penetrate to below the crust-mantle boundary. They can therefore be used to characterise the three dimensional crustal structure of the State using tomographic techniques, as well as providing more detailed two-dimensional structure when combined with the reflection profiles.

RECORDING STATIONS

Thirty-three analogue recorders were run continuously during the marine reflection profiling by the *Rig Seismic* (Surveys 148/159). Six University of Tasmania Observatory Network stations also operated continuously during the survey (Figure 1; Table 1). The output from the observatory stations was telemetered to Hobart where it was digitised and recorded.

Analogue Recorders

The analogue recorders were four-channel FM tape recording systems developed by AGSO (Finlayson and Collins, 1980). Six were based on modified Precision Instruments (PI) ½ inch tape decks with a maximum continuous recording period of 16 days using 7200 foot (2195 m) tapes. The remaining 27 were based on modified Akai or Tandberg ¼ inch tape decks with a maximum recording period of 4 days using 1800 ft (548 m) tapes.

The recorders were powered by external 12 volt batteries. The PI recorders require a dual supply: one 80 amp-hour battery was used for the amplifiers and clock (average current drain 60 mA), and six 80 amp-hour batteries for the tape deck and time signal radio (average current drain 750 mA). The Akai and Tandberg recorders were powered by a single 90 amp-hour battery (average current drain 250 mA). Because of their long endurance, the PI recorders were deployed at the remote sites to reduce the number of servicing visits required. These sites were deployed by fixed-wing aircraft or helicopters; to comply with safety regulations, the batteries used were Sonnenschein SL57 Dryfit sealed gel-cell batteries. These batteries

had a capacity of 80 amp-hours. Lead-acid batteries with a capacity of 90 amp-hours were used for all other recorders.

The seismometer was a single vertical component Willmore Mk II or Mk III seismometer with a natural frequency of 1.5 Hz. The seismic channel was recorded at two gain levels 24 dB apart. Generally, a high gain of 96 dB was used; actual gain levels are listed in Table 2. A bandpass filter was applied to the signal before recording (see Table 2 for gain and filter settings). Most filters were set with a bandpass of either 0.01-20Hz or 0.2-25Hz. The PI recorders used a specially designed filter of 6-100 Hz to reduce low-frequency background noise and enhance the predominant frequencies of the air-gun signal at long offsets (around 10-14 Hz).

A coded clock signal containing the days, hours, minutes and seconds was recorded on a third channel, and ten second pulses (and interpolated second pulses) from the Omega radio navigation facility at Yarram, Victoria, were recorded on a fourth channel. The clocks were synchronised to the radio time standard; the clock errors at the start and finish of the recording period are noted in Table 2. The clock drifts for each station are plotted in Appendix 4.

Observatory Network

The University of Tasmania maintains a seismic network comprising eight stations throughout Tasmania. The data from these stations are telemetered into the University at Hobart and recorded on analogue drum recorders. One channel is also telemetered to AGSO in Canberra.

The output from these stations was digitized on a PC-based system and written to hard discs. The digitizing software was written by Glen Self, Department of Pharmacology, University of Western Australia. It used a 10-channel Axiom DAC analog-to-digital board. The sample rate selected for the survey was 50 samples/sec. Time signals from a GPS clock board were digitised and recorded on a separate channel with the seismic signals.

Two of the eight observatory stations (Hobart and Moorelands) were not operational due to a fire shortly before the survey so only six stations were recorded. After the data were digitised and written to hard disc they were backed up on to Exabyte tapes.

Location of Stations

The land stations (Figure 1) were deployed by vehicles, helicopters (Stations 1, 2, 32), and fixed wing aircraft (Stations 7 and 31). Stations were located, as far as possible, to be in line with one or more of the offshore traverses. This could be achieved in a few cases (see Figure 1), but mostly the stations are offset to one side. Stations were deployed on King Island and Three Hummocks Islands to provide on-line reversed data for the north-western traverses (see Figure 2 for an example of data recorded at Three Hummocks Island). Since most stations

were operational during the entire period of the survey, they potentially recorded arrivals from all the offshore traverses. These data have a wide range of distances and azimuths and travel paths which pass through most of the major geological elements of Tasmania.

The stations were located using a Pronav GPS receiver set up as close to the seismometer as practicable. A series of at least 8 readings were taken at one minute intervals. The resultant positional data were averaged to give the positions listed in Table 1. The reference spheroid used was WGS - 84. Although the positions are given to two decimal places the accuracy of the GPS navigation system is quoted as being within 100 metres 99.7 percent of the time (SA turned on), ie. within approximately ± 71 metres in latitude and ± 71 metres in longitude (Featherstone, 1995). Short term averaging may reduce the error by about half, ie. the position should be within 50 metres of the true position.

ENERGY SOURCE

The sources of seismic energy recorded on the land stations were the air-guns used during the offshore reflection profiling, two large explosive shots fired within the array of land stations, quarry blasts and earthquakes.

Air-guns

The air-gun array deployed by *Rig Seismic* to shoot the offshore reflection profiles was used as the main energy source for the long-offset and tomography data. The array was a tuned 3000 cu. inch (50 litre) HGS sleeve air-gun array comprising 20 individual guns in two sub-arrays of 10 guns each. Each gun had a capacity of 150 cu. inch. The array was operated at 1800 psi and normally towed at a depth of 10 m. The shots were fired with a shot point interval of 50 m along the traverse, resulting in a variable firing rate of approximately 20 seconds, depending on the ship's speed (nominally 5 knots). The time of firing of each shot to within 0.01 second was obtained in Universal Time by synchronising the ship's seismic Data Acquisition System (DAS) clock with GPS time signals. The difference between the DAS clock and GPS does not exceed 10 ms.

Explosive Shots

Two explosive shots were drilled at Strickland as near as was practical to the centre of the array of land stations on Tasmania (Figure 1). The purpose of these shots was to provide some reversed data from the centre of the State. This is necessary so as to reduce the ambiguity introduced by uncertainties in the structure in the central part of the island. The offshore and near-shore structure is well defined because of the detailed profiling and generally good shot-station configuration; the central part has no such control on the upper and mid-crustal structure because only arrivals from the deep crust and upper mantle are recorded at these stations.

Each shot was drilled in a pattern of 4-inch diameter drill holes to an average depth of 60 metres. The first shot contained 700 kg of Power Gel explosive in 7 drill holes; the second shot contained 812 kg of explosive in 9 holes. Appendix 2 provides details of the patterns. The shots were fired electrically and timed by setting up an analogue shot-timing system at the site. This comprised a geophone, amplifier, Omega radio receiver and paper chart recorder. The single seismic channel and the 10 second pulses from the Omega radio were recorded on the chart so that the shots could be timed to within 10 ms.

Quarries

Several quarries fired large blasts during the survey period. These blasts are potentially useful as seismic sources. They are important as they provide sources within the array of seismic recording stations and therefore reverse the data provided by the marine shots around the periphery of the array. They also allow local structural information to be obtained to reduce the uncertainty in the interpretation of the deep data. A listing of some of the quarry blasts is given in Appendix 3. Other blasts may not be listed here; they may be identified later from the permanent observatory records. A list of contacts at these quarries is included in Appendix 3.

Earthquakes

Numerous earthquakes occurred during the deployment of the recording stations and arrivals from a number of these were possibly recorded. Because the earthquakes are located globally and at large distances from the stations, the travel paths of the seismic energy are generally close to vertical beneath the stations. These arrivals can be used to deduce teleseismic residual times, that is, the relative delay of the arrival at each station due to the variations in structure beneath each station. The majority of this variation occurs within the lithosphere so the method is useful for mapping the lithosphere thickness across the array. Table 4 lists the known events from around the world which occurred during the TASGO survey, and which have a preliminary magnitude of 5 or greater.

Location of Shots

Locations of the shot traverses and recording stations are shown in Figure 1 and listed in Tables 1 and 3. The *Rig Seismic* circum-navigated Tasmania, with the reflection traverses essentially parallel to the coastline. Additional traverses were shot along the west coast to target particular structures (Figure 1). Two lines orthogonal to the coast were shot in the southwest as part of the South Tasman Rise cruise. The eastern of the two was shot specifically for the onshore stations but with no acquisition of coincident reflection data after the loss of part of the *Rig Seismic's* streamer cable (Hill and others, 1995).

The shots were located by Differential Global Positioning System (DGPS). The positions of the initial and final shots along each traverse are listed in Table 3. The positions of the shots

are preliminary only as final reduction of all navigation information has yet to be applied. This may amount to a few tens of metres difference in the shot-station distances calculated from these values. The complete shot position and time values for all shots will be available after post-processing in a single file.

ACKNOWLEDGEMENTS

We thank Glen Self of the University of Western Australia for modifying his data acquisition software to enable the recording of Tasmanian Observatory data, and Prof R. Large of the University of Tasmania for access to the University of Tasmania seismic network data. The permission granted by many landholders to allow deployment of recording stations on their properties is gratefully acknowledged. Many others assisted in various ways with this survey; they are listed in Appendix 1.

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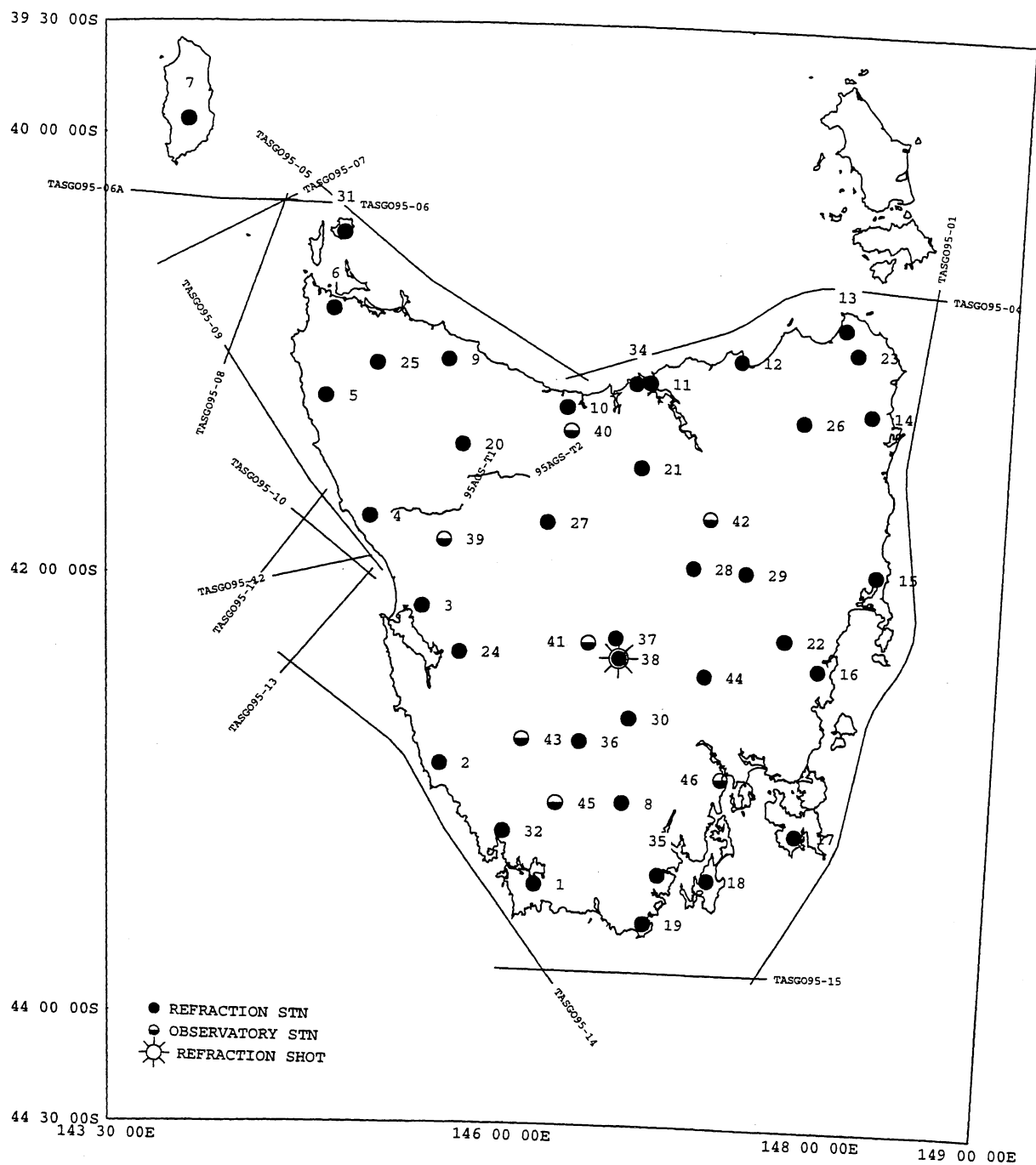


FIGURE 1. Location of Marine and Land Seismic Traverses, Shots and Stations

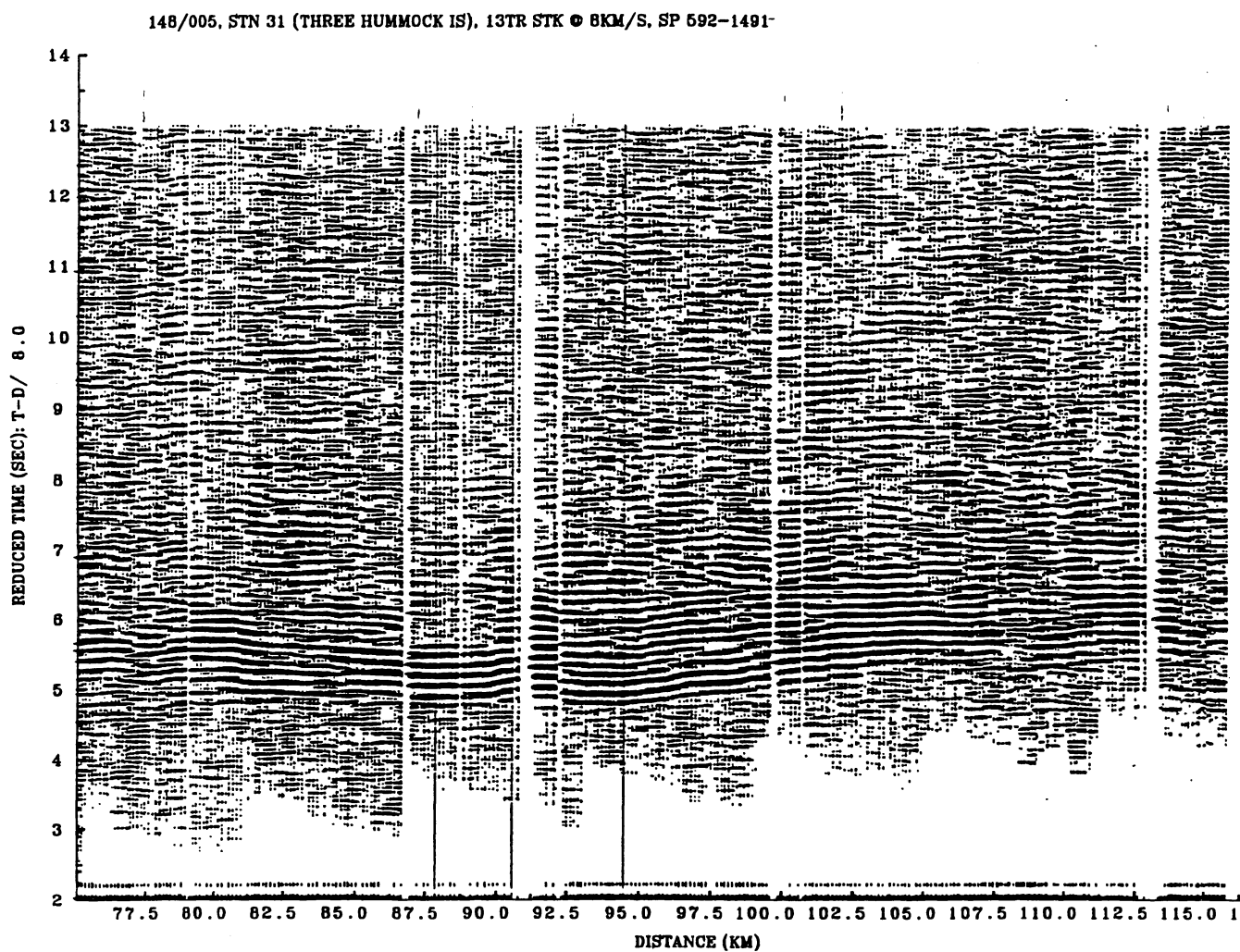


FIGURE 2. Example of refraction data recorded at Three Hummocks Island from R/V *Rig Seismic* Traverse 5.

Site No.	Set No.	Sensor No.	Site Name	Site location (WGS - 84)		Notes
				Longitude	Latitude	
1	19	17	Melaleuca	S 43 24.72	E 146 09.34	
2	17		Mt Wart	S 42 52.12	E 145 32.68	
3	24	5	Strahan	S 42 09.04	E 145 24.99	
4	29		Reece Dam	S 41 44.54	E 145 05.60	
5	1	30	Nelson Bay River	S 41 11.74	E 144 49.12	
6	13	32	West Montagu	S 40 47.92	E 144 51.65	
7	18	19	Grassy Road	S 39 56.67	E 143 59.45	
8	21	23	South Weld	S 43 01.91	E 146 41.79	
9	30	26	Lapoinya	S 41 01.45	E 145 32.98	
10	4	20	Forth	S 41 13.84	E 146 16.61	
11	25		Kelso	S 41 06.59	E 146 47.01	
12	28		Bridport	S 40 59.83	E 147 20.87	
13			Rushy Lagoon	S 40 49.92	E 147 58.51	
14	11	1	Priory	S 41 13.25	E 148 09.40	
15	5	4	Coles Bay Road	S 41 57.39	E 148 13.99	
16	6	15	Greenhills Road	S 42 23.90	E 147 54.02	
17	10.3	8	Randor Road	S 43 09.43	E 147 48.15	
18	2.10	5	Bruny Island	S 43 22.41	E 147 15.36	
19	7.8.20	2.19	Catamaran	S 43 34.75	E 146 51.21	
20	23		Guilford	S 41 24.59	E 145 38.84	
21	31		Shoulder of Mutton	S 41 29.94	E 146 44.83	
22	33		Stone House	S 42 15.97	E 147 41.14	
23	14		Gladstone	S 40 56.59	E 148 03.17	
24	3	32	Cracroft	S 42 21.56	E 145 39.30	
25	9	9	Trowutta	S 41 02.58	E 145 07.38	
26	32		Ringarooma	S 41 15.87	E 147 44.66	
27	22	26	Mags Road	S 41 45.53	E 146 10.68	
28	15		Lake River Road	S 41 56.88	E 147 05.65	
29	27		Fosterville	S 41 57.84	E 147 25.86	
30	12	3	Drypoles Road	S 42 38.72	E 146 43.33	
31	20	18	Three Hummocks Is.	S 40 27.10	E 144 54.98	
32	16		Port Davey	S 43 10.37	E 145 56.93	
33	26		Moorlands	S 42 26.50	E 147 11.42	
34	25		Badger Head	S 41 06.98	E 146 42.02	
35	8	2	Strathblane	S 43 21.36	E 146 56.13	
36	20	18	Needles	S 42 45.35	E 146 24.68	
37	7	7	Lake Echo	S 42 16.88	E 146 37.44	
38	10	2	Strickland	S 42 22.37	E 146 38.91	
39	101	U Of T	Mount Read	S 41 50.78	E 145 32.62	1
40	102	U Of T	Sheffield	S 41 20.25	E 146 18.45	1
41	103	U Of T	Tarraleah	S 42 18.25	E 146 27.00	1
42	104	U Of T	Savannah	S 41 43.25	E 147 11.33	1
43	105	U Of T	Strathgordon	S 42 45.05	E 146 03.20	1
44	106	U Of T	Moorelands	S 42 26.50	E 147 11.42	2
45	107	U Of T	Scotts Peak	S 43 02.30	E 146 16.50	1
46	108	U Of T	University	S 42 54.58	E 147 19.23	2
			Refraction Shots	S 42 22.36	E 146 38.82	1

Notes: 1) University of Tasmania Observatory Station

2) University of Tasmania Observatory Station (not operating)

TABLE 1. Station Positions

TABLE 2. Station Recording Times

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
1	Melaleuca	19	start	1/3/95 13:45	0.000		1:13:45			
			stop	19/3/95 12:22	0.000					No clock correction available, tape playback required
			start	19/3/95 12:56	0.000					
			stop	31/3/95 11:50	0.110					Tape stopped, there should be about 8 days of data
			start	31/3/95 11:58	0.002		31:11:50			(clock time shows day 1 10:00 hours)
			stop	12/4/95 13:51	60.000					Batteries dead, clock seems to be 1 minute fast
			-	12/4/95 13:52	0.000	-				Tape probably stopped on the 6 -th
2	Mount Osmond	17	-	1/3/95 9:59	0.000	-				
			start	1/3/95 10:00	0.003		1:09:50			
			stop	18/3/95 17:27	-0.550					
			start	18/3/95 18:17	0.000					
			stop	31/03/95 13:06	1.521					Tape skewed on head, clock error suspect
			start	31/3/95 13:16	0.000					
			stop	12/4/95 11:08	1.000					Battery flat, clock error highly suspect
			-	12/4/95 11:09	0.000	-				
3	Strahan	24	start	1/3/95 14:39	0.000	60:14:39		96	.2-25	
			stop	6/3/95 14:30	-0.054	71:11:07				Stop time is not correct should be day 65
			start	6/3/95 14:35	0.002	65:14:35				
			stop	8/3/95 11:01	-0.015	67:11:01				
			start	8/3/95 11:37	0.000	67:11:37				
			stop	12/3/95 10:50	-0.068	71:10:50				Clock out by 1 minute, corrected (plus or minus?,
			start	12/3/95 11:07	0.001	71:11:07				requires tape playback)
			stop	16/3/95 10:42	-0.063	75:10:42				
		23	start	16/3/95 10:48	0.000	75:10:48				
			stop	20/3/95 12:15	0.123	79:12:15				
			start	20/3/95 12:21	0.001	79:12:21				
			stop	24/3/95 10:05	0.123	83:10:05				
			-	24/3/95 10:06	0.000	-				
			start	7/4/95 12:44	0.000	97:12:44				
			stop	8/4/95 16:22	0.049	98:16:22				
			-	8/4/95 16:23	0.000	-				
4	Reece Dam	29	start	1/3/95 11:39	0.000	60:11:39	60:11:36	96	0.2-25	
			stop	6/3/95 9:45	-0.024	65:09:45				
			start	6/3/95 9:46	0.001	65:09:46				
			stop	8/3/95 14:41	-0.011	67:14:41				
			start	8/3/95 14:48	-0.001	67:14:48				

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			stop	12/3/95 13:59	-0.017	71:13:59				
			start	12/3/95 14:06	0.000	71:14:06				
			stop	16/3/95 12:15	-0.013	75:12:15				
			start	16/3/95 12:21	0.002	75:12:21				
			stop	20/3/95 14:49	-0.013	79:14:49				
			start	20/3/95 15:10	-0.002	79:15:10				Tape wrapped around capstan
			stop	24/3/95 8:25	-0.017	83:08:25				Recorder not working
			-	24/3/95 8:26	0.000	-				
			start	7/4/95 11:08	0.000	97:11:08		84	0.2~25	
			stop	10/4/95 16:02	0.003	100:16:02				Tape jammed motor not going
			-	10/4/95 16:03	0.000	-				
5	Nelson Bay River	1	start	1/3/95 16:44	-0.001	60:16:44		96	0.01~20	
			stop	6/3/95 13:08	-0.145	65:01:08				EST = clock time +12 hr, tape full
			start	6/3/95 13:13	0.000	65:01:13				"
			stop	10/3/95 11:30	-0.114	68:23:30				"
			start	10/3/95 12:01	0.002	69:12:01				(Clock reset) EST = clock time + 0
			stop	14/3/95 10:28	-0.125	73:10:28				
			start	14/3/95 10:35	0.001	73:10:35				
			stop	22/3/95 12:43	-0.310	81:12:43				
			-	22/3/95 12:44	0.000	-				
			start	6/4/95 10:15	-0.001	96:10:15				Time is EST
			stop	11/4/95 10:38	-0.209	2:10:38				Estimated clock error
			-	11/4/95 10:39	0.000	-				
6	West Montagu	13	start	1/3/95 14:25	0.002	60:02:25		96	0.01~20	EST = clock time +12 hr
			stop	6/3/95 10:57	0.017	64:22:57				EST = clock time +12 hr
			start	6/3/95 11:06	-0.001	65:11:06				(Clock reset) EST = clock time + 0
			stop	10/3/95 7:37	0.009	69:07:37				
			start	10/3/95 7:45	0.001	69:07:45				
			stop	14/3/95 7:38	0.012	73:07:38				
			start	14/3/95 7:51	0.001	73:07:51				
			stop	22/3/95 9:45	0.026	81:09:45				Tape full
			-	22/3/95 9:46	0.000	81:09:46				
			start	6/4/95 8:04	0.001	96:08:04		96	0.01~20	
			stop	8/4/95 10:00		~				Estimated end time only, battery stolen before pick up
			-	8/4/95 10:01	0.000	-				
7	Grassy Road	18	-	2/3/95 16:49	0.000	-				
			start	2/3/95 16:50	-0.003	2:16:50	2:16:59	96	6~100	Time is DLS ie. EST + 1 hour

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
				15/3/95 15:19	-0.417	15:15:19	15:15:19			Tape not turning, drag set to high
			-	15/3/95 15:20	0.000					Second calibration not written to tape but sounded OK
8	South Weld Road	21	-	8/3/95 17:19	0.000	-				
			start	8/3/95 17:20	2.000	8:17:20	8:17:20	120-18	6~100	Set up using watch only; error should be less than 1 sec
			stop	11/3/95 13:40	2.050	21:11:13	21:03:49			Major problems with this recorder. Time may be
			start	11/3/95 13:48	-0.002	11:13:48	11:14:01			fixable by playing back tape .No radio for first 2 times
			continue	21/3/95 10:47	0.056	21:10:47				Radio was changed as was clock.
			stop	29/3/95 12:09	0.100	29:12:09				Batteries flat
			-	29/3/95 12:10	0.000	-				
			start	6/4/95 13:17	-0.007	6:13:17	6:13:18			No 10 second pips (audible, they may be being detected)
			stop	9/4/95 16:15	-2.137	9:16:15	9:16:18			Pips return clock is 2137 ms slow
			-	9/4/95 16:16	0.000	-				
9	Lapoinya	30	start	1/3/95 12:48	0.002	60:12:48		96	0.2~25	
			stop	6/3/95 7:09	-0.060	6:07:09				
			start	6/3/95 7:10	0.000	6:07:10		90	"	Tape may start at 06:07:16
			stop	9/3/95 14:54	-0.054	9:14:54				
			start	9/3/95 15:08	-0.001	68:15:08		78	"	
			stop	13/3/95 14:04	-0.060	72:14:04				
			start	13/3/95 14:14	-0.001	72:14:14				
			stop	21/3/95 12:59	-0.124	80:12:59				
			-	21/3/95 13:00	0.002	-				
			-	6/4/95 13:17	0.000	-				
			start	6/4/95 13:18	-0.001	96:13:18		78	0.2~25	
			stop	11/4/95 9:45	-0.167	1:09:45				
			-	11/4/95 9:46	0.000	-				
10	Forth	4	start	1/3/95 9:06	0.004	60:09:06	60:08:52	96	0.01~20	
			stop	5/3/95 17:03	0.325	64:17:03				Ran out of tape; estimated end of tape 5/3/95 09:00.
			start	5/3/95 17:09	0.000	5:17:09				
			stop	9/3/95 11:57	0.278	9:11:57				
			start	9/3/95 12:00	0.000	9:12:00				
			stop	13/3/95 12:06	0.311	13:12:06				
			start	13/3/95 12:07	0.000	13:12:07				
			stop	19/3/95 16:35	0.484	19:16:35				
			-	19/3/95 16:36	0.000	-				
			start	5/4/95 15:56	0.000	5:15:56				
			stop	11/4/95 9:15	0.501	11:09:15				Ran out of tape; estimated end of tape at 9/4/95 16:00.
			-	11/4/95 9:16	0.000	-				

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
11	Kelso	25	start	1/3/95 14:40	0.002	60:14:40				
			stop	5/3/95 11:00	-0.090	64:11:00				Omega not working, this clock error is incorrect,
			start	5/3/95 11:10	-0.090	5:11:10				the error should be positive as are all the other errors
			stop	8/3/95 15:00	0.184	8:15:00				for this recorder (low seismic sensitivity, drop outs)
			start	8/3/95 15:34	0.000	8:15:34				
			re-start	8/3/95 16:00	0.000	8:16:00				
			stop	11/3/95 9:45	0.100	11:09:45				This site is noisy, recorder moved to Badgers Head
			-	11/3/95 9:46	0.000	-				site 34.
12	Bridport	28	-	1/3/95 16:47	0.000	-				
			start	1/3/95 16:48	-0.001	60:16:48	60:16:42	96	0.2-25	Power cable chewed by sheep, reconnected by farmer
			stop	5/3/95 13:40	-2.198	0:02:06				at power up the clock was reset to program ie times are
			start	5/3/95 13:52	0.000	5:13:52		96		wrong. (pick up may be at 5:13:46)
			stop	9/3/95 7:03	-0.054	9:07:03				(pick up may be 09:07:05)
			start	9/3/95 7:10	0.000	9:07:10				
			stop	13/3/95 7:44	-0.095	13:07:44				
			start	13/3/95 7:50	0.000	13:07:50				
			stop	19/3/95 8:18	-0.158	19:08:18		102		Out of tape; estimated end of tape 17/3/95 08:00
			-	19/3/95 8:18	0.000	-				
			start	6/4/95 9:54	0.000	6:09:54		96		
			stop	9/4/95 15:21	-0.108	9:15:21				
			-	9/4/95 15:22	0.000	-				
13	Rushy Lagoon		start	2/3/95 14:51	0.000	2:14:51	2:14:51	96	0.01-20	
			stop	6/3/95 18:56	-0.017	6:18:56				Clock may be 1 second out although jump may have
			start	6/3/95 19:06	0.001	6:19:06				occurred when the battery was changed (time recorded
			continue	8/3/95 8:04	-0.007	8:09:04				as 18:56 on tape box)
			stop	10/3/95 15:00	-0.007	10:15:00				
			start	10/3/95 15:04	0.000	10:15:04				(Clock reset)
			stop	14/3/95 15:31	-1.164	14:15:31				Clock slow by 1 second and 164 ms. I suspect that the
			start	14/3/95 15:33	0.000	14:15:33				display is probably jumping not the clock drifting (reset)
			stop	18/3/95 16:50	0.012	18:16:50				
			-	18/3/95 16:51	0.000	-				
			start	6/4/95 13:17	0.000	6:13:17				
			stop	9/4/95 13:29	0.020	9:13:29				
			-	9/4/95 13:30	0.000	-				
14	Priory	14	start	2/3/95 12:50	0.000	2:12:50	2:12:50			Damping resistor hard wired to Mk 3.
			stop	6/3/95 14:57	-0.032	6:14:57				

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			start	6/3/95 15:02	-0.035	6:15:02				
			stop	10/3/95 12:00	-0.063	10:12:00				
			start	10/3/95 12:08	0.000	10:12:08				Modulator board reseated, offset LED is now OK.
			stop	14/3/95 13:22	-0.034	14:13:22				
			start	14/3/95 13:26	0.000	14:13:26				
			stop	18/3/95 15:26	-0.036	18:15:26				Calibrator causes hum in amplifier circuits
			-	18/3/95 15:27	0.000	-				
			start	6/4/95 14:50	0.000	6:14:50				
			stop	9/4/95 11:51	-0.023	9:11:51				Tape stopped before end but should have recorded 2.8 days of data
			-	9/4/95 11:52	0.000	-				
15	Coles Bay Road	5	start	2/3/95 11:00	0.000	61:11:00		96	0.02~20	
			stop	6/3/95 12:56	0.147	64:12:59				Date should be 6/3/95
			start	6/3/95 12:59	0.147	64:12:59				"
			stop	9/3/95 11:02	0.307	68:11:02				Displayed day is 78 reset to 68
			start	9/3/95 11:11	0.000	68:11:11				
			stop	13/3/95 10:07	0.162	72:10:07	72:10:14			
			start	13/3/95 10:12	0.162	72:10:12				
			stop	17/3/95 1:06	0.330	76:13:06				
			-	17/3/95 1:07	0.000	-				Marked as EST day 18?
			start	6/4/95 16:43	0.000	6:16:43				
			stop	8/4/95 18:54	0.131	8:18:54	8:15:54			
			-	8/4/95 18:55	0.000	-				
16	Green Hills Road	6	-	2/3/95 12:32	0.000	-				
			start	2/3/95 12:33	0.003	61:12:33	61:12:30	96	0.01~20	
			stop	6/3/95 11:23	0.072	64:11:23				EST + 4 hours
			start	6/3/95 11:36	0.072	64:15:36				
			stop	9/3/95 9:43	0.132	68:13:43				
			start	9/3/95 9:55	0.132	68:13:55				EST + 3 hours
			stop	13/3/95 11:23	0.195	71:19:23	13:11:26			
			start	13/3/95 11:30	0.003	13:11:30				Date should be 72:11:30 EST, ie + 1 day, reset to day 13
			stop	17/3/95 11:16	0.065	17:11:16				some confusion exists as to the correct day 17 or 18
			start	17/3/95 11:19	0.000	17:11:19				this recorder seems to be loosing days somewhere
			stop	21/3/95 10:21	0.055	21:10:21				
			start	21/3/95 10:24	0.000					Estimated start time and clock error.
			stop	30/3/95 14:30	0.126					Time recorder switched off
			-	30/3/95 14:31	0.000	-				
			start	7/4/95 8:24	0.000	7:08:24				Time is EST.
			stop	8/4/95 17:30	0.023	8:17:30	8:17:30			

TABLE 2 (Contd)

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			-	8/4/95 17:31	0.000	8:11:48				
17	Randor Road	10	start	28/2/95 20:37	0.000	28:20:27	Calib. US	120	0.01~20	Time is DLS ie. EST + 1 hour.
			stop	4/3/95 19:25	0.072	32:19:25				
			start	4/3/95 19:44	0.000	4:19:44				
			stop	8/3/95 10:40	0.050	8:10:40				
			start	8/3/95 11:03	0.050	8:11:03		96	"	
			stop	12/3/95 14:09	0.144	12:14:09				
			start	12/3/95 15:14	0.000	12:15:14	12:15:20	120	"	
			stop	16/3/95 12:27	0.125	16:12:27				
			start	16/3/95 12:30	0.000	16:12:30				
			stop	20/3/95 17:50	0.115	20:17:50				
			start	20/3/95 17:56	0.115	20:17:56				
			stop	22/3/95 9:36	0.153	22:09:36				
			-	22/3/95 9:37	0.000	-				
		7	start	6/4/95 9:22	-0.001	6:09:22	6:09:20	96	"	Recorder changed to # 7. time is EST.
			stop	8/4/95 15:18	-0.015	8:15:18	8:15:19			
			-	8/4/95 15:19	0.000	-				
18	Bruny Island		start	1/3/95 11:19	0.006	1:11:19	1:11:20	96	0.01~20	EST - 1 hour (DLS)
			stop	5/3/95 11:02	0.026	5:11:02				No Omega, error is under 1 second (clock err est. only)
			start	5/3/95 11:09	0.026	5:11:09				(clock error is only an estimate for plotting!)
			stop	9/3/95 14:59	0.055	9:14:59				Omega working
			start	9/3/95 15:11	0.059	9:15:11		120-12	"	
			stop	12/3/95 8:14	0.064	12:08:14		96	"	Sensor changed
			re-start	12/3/95 10:12	-0.001	12:10:12				
			stop	13/3/95 8:45	0.005	13:08:45	13:08:48			Unknown clock error (clock err est. for plotting only)
			start	13/3/95 8:45	0.000					Approximate start time
			stop	17/3/95 17:09	0.004	18:03:09	17:17:35			
			start	17/3/95 17:34	0.005	17:17:34				
			-	21/3/95 14:50	0.007	21:14:50				
			stop	21/3/95 15:23	0.008	21:15:23	21:15:23			
			start	21/3/95 15:24	0.000	-				
			est. stop	26/3/95 0:00	0.003	?				Estimated end of tape (clock err est. for plotting only)
			start	6/4/95 17:07	-0.001	6:17:07	6:17:06			Time is EST. Tape starts before recorded start time.
			stop	9/4/95 12:21	-0.001	9:12:21	9:12:24			
			-	9/4/95 12:22	0.000	-				
19	Catamaran	7	start	1/3/95 17:56	-0.001	1:17:56	1:17:57			Time is DLS, ie. EST + 1 hour

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			stop	5/3/95 16:40	-0.015	5:18:40				End time should be 16:40 not 18:40.
			start	5/3/95 16:48	0.003	5:16:48	5:16:49			
			stop	9/3/95 11:06	-0.013	9:11:06				
			start	9/3/95 11:13	-0.013	9:11:13				
			stop	13/3/95 13:00	-0.015	5:13:00				
			start	13/3/95 13:04	-0.014	13:13:04	13:13:05			
			stop	17/3/95 21:34	-0.016	17:21:34				No Omega, tape ran out before change.(clock error for plotting only) Recorder Changed
		8	start	17/3/95 22:15	0.002	17:22:15				
			stop	19/3/95 18:31	-0.382					Recorder ate tape (possible clock error -.382) 19:18:31
		20	start	19/3/95 19:10	0.001	19:19:10	19:19:22			Recorder changed to PI from site 31
			stop	28/3/95 13:05	-0.002					Clock error may be incorrect due to low bat V. 28:13:05
			-	28/3/95 13:06	0.000	-				
			-	7/4/95 9:54	0.000	-	9:09:57			
			start	7/4/95 9:55	0.002	7:09:55	9:18:39			EST.
			stop	9/4/95 18:38	-0.009	9:18:38				
			-	9/4/95 18:39	0.000	-				
20	Guilford	23	start	1/3/95 9:02	0.000	60:09:02		96	0.2~25	
			stop	6/3/95 9:41	0.129	65:09:41				
			start	6/3/95 9:43	0.001	65:09:43				
			stop	9/3/95 7:38	0.074	68:07:38				Set on low gain not radio
			start	9/3/95 7:48	0.000	68:07:48				
			stop	13/3/95 7:37	0.125	72:07:37				
			start	13/3/95 7:47	0.001	72:07:47				
			stop	16/3/95 14:10	0.118	75:14:10				Tape wrapped around head
			start	16/3/95 14:30	0.001	75:14:30				
			stop	21/3/95 10:44	0.174	80:10:44				
			-	21/3/95 10:45	0.000	-				
		24	start	7/4/95 9:07	0.000	97:09:07		96	0.2~25	Recorder changed
			stop	9/4/95 12:47	-0.024	99:12:47				Snow
			-	9/4/95 12:48	0.000	-				
21	Sorento Park	31	start	1/3/95 12:47	0.002	60:12:47		104	0.2~25	Damping set for MKII, reset at first tape change
			stop	5/3/95 8:43	-0.036	64:08:43				No Omega, seconds (Telecom) OK ,but no clock correct.
			start	5/3/95 8:43	-0.036	64:08:43				"
			re-start	5/3/95 9:21	-0.049	5:09:21				Still no Omega , only days display changed.
			stop	9/3/95 10:12	0.068	9:10:12		96		
			start	9/3/95 10:22	0.000	9:10:22				
			stop	13/3/95 10:15	0.040	13:10:15				Clock error written on tape 40 ms fast.
			start	13/3/95 10:20	0.000	13:10:20				Tape stopped at about 13:08 ie 2 hours lost

TABLE 2 (Contd)

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			stop	19/3/95 14:39	0.097	19:14:39				Tape stopped, probably on day 14.
			-	19/3/95 14:40	0.000	-				
			start	5/4/95 17:43	0.000	5:17:43				
			stop	8/4/95 17:27	0.070	8:17:27				
			-	8/4/95 17:28	0.000	-				
22	Stone House	33	start	2/3/95 8:21	0.000	61:08:21	61:08:21	96	0.2-25	
			stop	6/3/95 14:00	-0.034	65:14:00				Ran out of tape
			start	6/3/95 14:05	0.000	6:14:05		90		Gain change
			stop	10/3/95 7:55	-0.020	10:07:55				
			start	10/3/95 8:00	0.000	10:08:00		96		"
			stop	14/3/95 9:24	-0.028	14:09:24				Clock error on tape box -0.029
			start	14/3/95 9:27	0.000	14:09:27		102		"
			stop	18/3/95 9:36	-0.037	18:09:36				
			start	18/3/95 8:39	0.000	18:09:39				
			stop	22/3/95 8:52	-0.037	22:08:52				End time may be 22:08:48
			-	22/3/95 8:53	0.000	-				
			start	7/4/95 9:37	0.000	7:09:37		96		"
			stop	8/4/95 12:54	-0.015	8:12:54				
			-	8/4/95 12:55	0.000	-				
23	Gladstone	8	start	2/3/95 14:00	0.000	-				Approximate times only, no data recorded.
			stop	6/3/95 18:00	-0.380	-				Tape eaten no data recorded (clock err. only for plotting)
			start	6/3/95 18:04	0.000	6:18:04				
			continue	8/3/95 8:05	-0.376					
			stop	10/3/95 13:25	-0.887	10:13:25				887 ms slow, tape wrapped around capstan, (about 10:12:00)
			start	10/3/95 13:33	0.000	10:13:33				Take-up spools adjusted.
			re-start	10/3/95 14:08	0.000	10:14:08				Station picked up, repaired and redeployed at Catamaran, site 19.
			stop	14/3/95 14:37	-0.855	14:14:37				
			-	14/3/95 14:38	0.000	-				
24	Carcroft	3	start	2/3/95 8:34	0.001	61:08:34	61:08:33	96	0.01-20	
			stop	5/3/95 16:26	-0.024	64:16:26				This tape has been rewound not just removed.
			start	5/3/95 16:46	-0.001	64:16:46				
			stop	8/3/95 8:56	-0.006	67:08:56				
			start	8/3/95 9:07	0.001	67:09:07				
			stop	12/3/95 9:00	-1.916	71:09:00				Clock out by about 2 seconds ,error maybe only on display (anomalous clock error suggests tape should be replayed)
			start	12/3/95 9:18	0.001	71:09:18				
			stop	16/3/95 9:05	-0.020	75:09:05				
			start	16/3/95 9:14	0.000	75:09:14				

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			stop	20/3/95 10:12	-0.017	79:10:12				
			start	20/3/95 10:21	0.000	79:10:21				
			stop	24/3/95 11:39	-0.019	83:11:39				
			-	24/3/95 11:40	0.000	-				
			start	26/3/95 15:15	-0.001	85:15:15				
		8	stop	1/4/95 17:57	-0.571	91:17:57				T+K300ape jammed, recorder changed to # 8 (clock error may be the result of low battery voltage)
			-	1/4/95 17:58	0.000	-				
			start	7/4/95 14:29	0.000	97:14:29				
			stop	8/4/95 14:45	-0.189	98:14:45				
			-	8/4/95 14:46	0.000	-				
25	Trowutta	9	start	2/3/95 11:16	0.000	60:11:16		96	0.01~20	Aerial wire chewed, (probably should read sensor wire), No calibration recorded
			stop	6/3/95 14:57	0.033	65:14:57				
			start	6/3/95 15:07	0.000	65:15:07				
			stop	10/3/95 8:51	0.025	69:08:51				
			start	10/3/95 10:30	0.000	69:10:30				
			stop	14/3/95 12:16	0.018	73:12:16				
			start	14/3/95 12:22	0.000	73:12:22				
			stop	22/3/95 13:36	0.032	81:13:36				
			-	22/3/95 13:37	0.000	-				
			-	6/4/95 11:34	0.000	-				
			start	6/4/95 11:35	-0.001	96:11:35		96	0.01~20	
			stop	11/4/95 11:34	0.028	1:11:34				Water in sensor, displays only shows 2 digits, display should read day 101
			-	11/4/95 11:35	0.000	-				
26	Hingarooma	32	start	2/3/95 16:50	0.000	2:16:50		90	0.2~25	Windy, noisy
			stop	6/3/95 17:23	-0.180	6:17:23				Seismic amplifier appears to saturate easily.
			start	6/3/95 17:35	0.000	6:17:35				
			stop	10/3/95 16:34	-0.141	10:16:34				
			start	10/3/95 16:40	0.000	10:16:40				
			stop	14/3/95 17:15	-0.276	14:17:15		96		Clock error on tape box -0.275
			start	14/3/95 17:18	0.000	14:17:18		102		
			stop	19/3/95 9:41	-0.345	19:09:41		96		Tape ran out on 18-th, clock error tape box -0.346
			-	19/3/95 9:42	0.000	-				
			start	6/4/95 11:24	0.000	6:11:24				
			stop	10/4/95 10:08	-0.273	10:08:54				
			-	10/4/95 10:09	0.000	-				
27	Mags Road	22	start	28/2/95 13:08	0.000	28:13:08		90	5~25	Time is DLS ie. EST + 1 hour
			stop	4/3/95 18:09	-0.029	32:18:09	32:18:16			Audio switch on high, at change over time was reset to EST(tape wrapped around guide)
			start	4/3/95 17:24	0.000	4:17:24				
			stop	9/3/95 10:21	-0.036	9:10:21				Tape full

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			start	9/3/95 11:06	0.000	68:11:06		78		Clock reset to day of year, high chan. checked OK at head
			stop	13/3/95 11:00	0.027	72:11:00				Tape full
			start	13/3/95 11:10	-0.001	72:11:10				
			stop	21/3/95 9:03	-0.067	80:09:03				
			-	21/3/95 9:04	0.000	-				
			start	6/4/95 16:48	-0.002	96:16:48		78	.2-25	Low cut filter reset
			stop	9/4/95 10:24	-0.005	99:10:24				
			-	9/4/95 10:25	0.000	-				
28	Lake River Road		start	1/3/95 15:07	0.002	60:15:07	60:15:08	96	0.01~20	
			stop	6/3/95 11:10	0.155	65:11:10				Ran out of tape 5/3/95
			start	6/3/95 11:20	0.001	6:11:20				Tape may have started at 06:11:26
			stop	9/3/95 15:20	0.068	9:15:20				1 hour before local time
			start	9/3/95 15:27	0.000	9:15:27		90		
			stop	13/3/95 13:15	0.250	13:15:45				Ran out of tape at about 13:15:00
			start	13/3/95 15:47	0.000	13:15:47		96		
			stop	20/3/95 11:13	0.605	20:11:13				
			-	20/3/95 11:14	0.000	-				
			start	7/4/95 11:47	0.000	7:11:47				
			stop	8/4/95 15:34	0.141	8:15:34				
			-	8/4/95 15:35	0.000	-				
29	Fosterville	27	start	2/3/95 11:00	-0.001	61:11:00	61:11:10	90	0.2-25	
			stop	6/3/95 12:00	-0.038	65:12:44				Take up spool sticking, only about 1 day recorded.
			start	6/3/95 12:59	0.000	6:12:59		96		
			stop	9/3/95 16:50	-0.024	9:16:52				Tape wrapped around spindle.
			start	9/3/95 17:00	0.000	9:17:00		72		
			stop	13/3/95 17:05	-0.058	13:17:05				
			start	13/3/95 17:09	0.000	13:17:09				
			stop	20/3/95 13:10	-0.092	20:13:10				Tape ran out day 17/3/95
			-	20/3/95 13:11	0.000	-				
			start	7/4/95 14:00	0.000	7:14:00				
			stop	8/4/95 14:14	-0.017	8:14:14				
			-	8/4/95 14:15	0.000	-				
30	Drypoles Road	12	start	1/3/95 18:45	0.000	1:18:45	1:18:45			
			stop	5/3/95 20:17	-0.010	5:20:17				
			start	5/3/95 20:33	0.002	5:20:33				
			stop	9/3/95 19:19	0.000	9:19:19				End of tape eaten
			start	9/3/95 19:23	0.000	9:19:23				

TABLE 2 (Contd)

Station #	Site Name	Recorder #	Start/Stop	Date/Time (EST)	Clock error (seconds)	Tape Time	Cal. Time	Gain	Filter	Comments
			stop	13/3/95 18:31	-0.020	13:18:31				
			start	13/3/95 18:38	-0.020	13:18:38	13:18:38			
			est. stop	17/3/95 9:00	-0.040					Estimated stop time and drift
			start	17/3/95 9:27	0.000	17:09:27				
			stop	31/3/95 18:21	-0.303	31:18:21				Final clock error may not be a true indication of drift
			-	31/3/95 18:22	0.000	-				due to low battery voltage, tape ran out.
			start	7/4/95 16:13	0.002	7:16:13	7:16:14			
			stop	8/4/95 12:20	-0.005	8:12:20	8:12:21			
			-	8/4/95 12:21	0.000	-				
			-	2/3/95 9:20	0.000					
31	Three Hummocks	20	start	2/3/95 9:21	-0.003	2:09:21	Cal US	96	6~100	Time is DLS ie. EST + 1 hour, calibrator US
			stop	16/3/95 9:22	0.153	16:09:22				
			-	16/3/95 9:23	0.000	-				
			-	1/3/95 11:47	0.000					
32	Port Davey	16	start	1/3/95 11:48	0.001					Time is Tasmanian ie DLS ie. EST + 1 hour
			stop	19/3/95 10:33	-0.164					"
			start	19/3/95 10:43	0.002					"
			stop	31/3/95 14:00	-0.250					(Time and clock error estimated for plotting only)
			start	31/3/95 14:26	0.000					Time is EST.
			stop	12/4/95 12:33	-0.324					No 10 second pips, clock error is well under a second
			-	12/4/95 12:34	0.000	-				
33	Moorlands	26	start	4/3/95 9:10	0.000	4:09:10		90	0.2~25	Set up in Hobart Uni's Moorlands vault.
			stop	7/3/95 15:00	-0.016	7:15:00				
			start	7/3/95 15:05	0.005	7:15:05				
			stop	10/3/95 19:36	-0.013	10:19:36				
			start	10/3/95 19:46	-0.015	10:19:46				
			-	12/3/95 9:23	-0.024	-		96	0.2~25	
			stop	16/3/95 8:10	-0.040	16:08:10				2 days of data lost, tape ends at approx 14:20:00
			start	16/3/95 8:15	0.000	16:08:15		102	0.2~25	
			stop	20/3/95 14:54	-0.031	20:14:54				
			start	20/3/95 15:01	0.000	20:15:01		96	0.2~25	
			stop	30/3/95 11:52	-0.039	30:11:52				Tape probably runs out on the 24-th
			-	30/3/95 11:53	0.000	30:11:53				
			start	7/4/95 15:16	0.000	7:15:16				
			stop	8/4/95 11:48	-0.005	8:11:48				
			-	8/4/95 11:49	0.000	-				
34	Badgers Head		start	11/3/95 10:50	0.000	11:10:50	11:10:57	96	0.2~25	See site 11 Kelso for data recorded prior to this date.

TABLE 2 (Contd)

	Traverse	Shot No.	Julian			Local Daylight Saving Time (DLS = EST + 1Hr) (UT + 11 H)						Latitude (S)		Longitude (E)		Water
			Day	Hour	Month	Day	Hour	Minute	Second	Sec*10 ⁻²	Degree	Minute	Degree	Minute	Depth (m)	
Start	015	100	62	4	3	3	15	50	10	69	43	47.999	145	55.513	-589	
End	015	2915	62	20	3	4	7	37	9	2	43	48.158	147	40.454	-160	
Start	001	100	63	1	3	4	12	15	0	85	43	49.772	147	34.514	-157	
End	001	7607	64	21	3	6	8	13	47	7	40	36.862	148	30.994	-43	
Start	004	100	65	3	3	6	14	16	5	94	40	39.979	148	33.787	-53	
End	004	4203	66	1	3	7	12	42	42	59	41	6.140	146	15.557	-24	
Start	005	100	66	7	3	7	18	18	59	23	41	6.451	146	23.728	-34	
End	005	1634	66	23	3	8	10	59	21	22	40	13.709	144	44.563	-54	
Start	006	100	67	5	3	8	16	57	17	33	40	19.601	144	57.627	-53	
End	006	654	67	8	3	8	19	51	30	29	40	18.858	144	38.096	-53	
Start	06A	1655	67	22	3	9	9	11	49	61	40	18.862	144	38.061	-53	
End	06A	3333	68	7	3	9	18	59	44	99	40	16.199	143	38.993	-94	
Start	007	100	68	13	3	10	0	23	55	93	40	36.301	143	48.693	-79	
End	007	1665	68	21	3	10	8	37	19	34	40	17.084	144	37.988	-61	
Start	8	100	69	20	3	11	7	12	55	13	40	17.016	144	34.575	-71	
End	8	1926	70	5	3	11	16	29	42	89	41	3.470	144	12.778	-114	
Start	9	100	70	9	3	11	20	9	35	88	40	58.475	144	12.869	-110	
End	9	2877	70	23	3	12	10	38	46	87	41	59.560	145	10.444	-42	
Start	10	100	71	23	3	13	10	42	42	43	42	2.017	145	8.144	-54	
End	10	1206	72	5	3	13	16	23	3	37	41	42.997	144	37.320	-138	
Start	11	150	72	10	3	13	21	38	35	18	41	38.800	144	48.833	-49	
End	11	1163	72	16	3	14	3	55	55	79	42	0.643	144	26.796	-1706	
Start	12	100	72	18	3	14	5	1	55	0	42	1.582	144	30.964	-1411	
End	12	1107	73	0	3	14	11	6	5	98	41	55.433	145	6.469	-48	
Start	13	132	73	3	3	14	14	15	31	73	41	59.758	145	6.179	-75	
End	13	1508	73	11	3	14	22	26	34	59	42	28.212	144	34.014	-1721	
Start	14	100	73	16	3	15	3	33	23	76	42	22.497	144	33.096	-1690	
End	14	4446	74	18	3	16	5	2	20	61	43	50.451	146	16.257	-162	

TABLE 3. Marine Shot Traverse Statistics

	Traverse	Shot No.	Julian		Local Daylight Saving Time (DLS = EST + 1Hr) (UT + 11 H)						Latitude (S)		Longitude (E)		Water
			Day	Hour	Month	Day	Hour	Minute	Second	Sec*10 ⁻²	Degree	Minute	Degree	Minute	Depth (m)
Start	STR-A	100	75	10				53			43	23.503	145	49.402	-120
End	STR-A	4295	76	11				33			44	27.292	143	39.886	-4803
Start	STR-Z	20	77	9				3			45	19.077	144	55.337	-2063
End	STR-Z	3001	78	12				5			44	1.676	144	24.481	-4347
Start	STR-B	100	79	5				10			45	8.010	143	51.998	-4803
End	STR-B	1990	79	16				2			44	51.325	144	59.956	-2749
Start	STR-Y										44	30.000	145	50.000	
End	STR-Y										43	48.030	146	13.780	

NOTE: Line STR-Y was shot without the seismic cable. Air-guns were deployed for refraction stations. Final data for South Tasman Rise lines not available at time

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Earthquakes for Teleseismic Studies

DATE 1995	UNIVERSAL TIME HR MIN SEC	LAT	LONG	DEP	GS MB	AGS MsZ	SD	REGION AND COMMENTS
1-Mar	020423.70	55.668N	161.297E	92D	5.4		0.7	161 NEAR COAST OF KAMCHATKA
2-Mar	160302.80	26.055S	179.556E	00G	4.8		1.0	45 SOUTH OF FIJI ISLANDS
	175250.90	05.170S	151.844E	13?	4.8		1.1	24 NEW BRITAIN REGION, P.N.G.
3-Mar	114605.00	06.559S	154.883E	70G	5.4	5.4	0.8	77 SOLOMON ISLANDS
	120214.50	06.485S	154.879E	70G	5.8	5.6	0.7	109 SOLOMON ISLANDS. Mw 5.8 (HRV).
	211239.30	14.546S	175.664W	33N	5.6	5.7	0.6	90 SAMOA ISLANDS REGION. Mw 5.9
	222650.70	04.810S	151.754E	09D	5.0		0.9	53 NEW BRITAIN REGION, P.N.G.
4-Mar	045458.30	00.080N	126.880E	33N	5.0		1.1	15 NORTHERN MOLUCCA SEA
	175637.40	13.999S	014.412W	10G	5.4	5.0	1.4	58 SOUTHERN MID-ATLANTIC RIDGE
5-Mar	111103.30	18.603S	169.136E	50G	5.0		0.8	53 VANUATU ISLANDS
	220836.30	31.676S	071.917W	68?	4.8		0.8	13 NEAR COAST OF CENTRAL CHILE.
6-Mar	184342.20	02.675N	118.246E	33N	5.5	5.8	1.2	28 CELEBES SEA. Mw 6.3 (GS). Moment
	184401.00	15.536N	092.051W	70D	5.0		1.0	69 MEXICO-GUATEMALA BORDER REG.
7-Mar	035813.70	36.743N	027.852E	33N	5.1		0.5	29 DODECANESE ISLANDS. ML 4.9
8-Mar	034559.00	16.589N	059.540W	10G	6.2	6.2	0.6	210 LEEWARD ISLANDS. Mw 6.4 (GS).
9-Mar	183656.10	20.960N	122.024E	33N	5.0	5.3	1.4	29 PHILIPPINE ISLANDS REGION
	234818.70	43.986N	149.869E	33N	5.1	4.5	1.3	18 EAST OF KURIL ISLANDS
10-Mar	052222.40	46.061N	143.505E	52D	5.5		0.9	164 SAKHALIN ISLAND. Mw 5.7 (HRV).
	062013.70	04.470S	151.260E	33N	4.9		1.1	9 NEW BRITAIN REGION, P.N.G.
	072123.70	18.328S	069.035W	70G	4.9		0.8	49 NORTHERN CHILE
	082237.80	11.542S	130.836W	10G	5.4	4.9	0.8	73 SOUTH PACIFIC OCEAN.
11-Mar	152110.40	43.963N	148.105E	33N	6.0	5.7	0.7	203 EAST OF KURIL ISLANDS. Mw 6.1
12-Mar	094155.70	10.822S	166.087E	33N	4.7	4.8	1.1	22 SANTA CRUZ ISLANDS
	120943.80	05.306S	146.650E	31D	5.5		0.8	65 EASTERN NEW GUINEA REG., P.N.G.
13-Mar	103149.80	02.828S	134.448E	33N	5.4	5.8	1.3	40 IRIAN JAYA REGION, INDONESIA
	135031.70	16.310S	173.486W	94D	5.0		0.9	29 TONGA ISLANDS
	205325.70	039.910N	143.60 E	33N	5.0	4.5	0.9	11 OFF EAST COAST OF HONSHU, JAP.
14-Mar	033233.90	37.958S	073.394W	33N	5.1	4.3	0.9	32 NEAR COAST OF CENTRAL CHILE
	062716.70	18.973N	121.460E	33N	5.1		1.5	17 LUZON, PHILIPPINE ISLANDS
	081317.20	04.680S	144.649E	33N	5.2		0.9	16 NEAR N COAST OF PNG.
	173350.80	54.830N	161.265W	33N	6.1	6.0	1.1	195 ALASKA PENINSULA. Mw 6.2 (GS).
15-Mar	023132.90	14.972N	118.673E	33N	5.1	5.1	0.9	29 PHILIPPINE ISLANDS REGION
16-Mar	043444.70	21.548S	176.598W	81D	5.4		0.9	108 FIJI ISLANDS REGION. Mw 5.7
	081118.20	42.292N	142.454E	33N	5.0	4.1	0.7	53 HOKKAIDO, JAPAN REGION. Felt (III JMA) at Urakawa.
	084935.50	22.008N	142.930E	50G	5.0		0.9	67 VOLCANO ISLANDS REGION
	111100.00	38.300N	142.715E	33N	5.0	5.1	0.8	39 NEAR EAST COAST, HONSHU, JAP.
	120449.00	58.450N	154.650W	0G				45 ALASKA PENINSULA. <AEIC>. ML 3.3
	143348.20	29.284S	068.248W	13D	5.1		1.1	62 SAN JUAN PROVINCE, ARGENTINA
17-Mar	021839.90	13.199S	166.710E	33N	5.4	5.3	0.9	54 VANUATU ISLANDS
18-Mar	092719.20	29.281N	140.648E	03D	5.5		0.8	135 SOUTH OF HONSHU, JAPAN
	180238.70	42.487N	087.059E	33N	5.2	4.3	0.8	106 NORTHERN XINJIANG, CHINA
19-Mar	095234.20	06.229S	131.347E	33N	5.0		0.7	16 TANIMBAR ISLANDS REG. INDONESIA
	114330.20	43.823N	147.885E	50D	5.3		0.8	153 KURIL ISLANDS
	155916.40	09.087S	109.490W	10G	5.0	5.1	1.2	46 CENTRAL EAST PACIFIC RISE
	183405.50	04.276S	135.104E	33N	5.7	6.3	1.3	54 IRIAN JAYA REGION, INDONESIA. Mw
	235313.90	04.246S	135.168E	33N	6.1	7.2	1.2	77 IRIAN JAYA REGION, INDONESIA. Mw
20-Mar	002220.00	04.143S	135.171E	33N	5.1		1.2	9 IRIAN JAYA REGION, INDONESIA
	003550.40	04.167S	134.938E	33N	5.1		1.1	13 IRIAN JAYA REGION, INDONESIA
	022453.10	03.968S	135.327E	33N	5.0		1.0	30 IRIAN JAYA REGION, INDONESIA
	061147.50	04.249S	134.975E	33N	5.0	5.0	1.1	20 IRIAN JAYA REGION, INDONESIA
	074326.60	03.61 S	134.90 E	33N	5.0		0.6	12 IRIAN JAYA REGION, INDONESIA
	081451.90	08.003S	116.423E	37D	5.6		1.2	41 SUMBAWA REGION, INDONESIA
	095138.00	01.096N	100.107E	93?	5.0		0.5	34 NORTHERN SUMATERA, INDONESIA

TABLE 4. Earthquakes for Teleseismic Studies

DATE 1995	UNIVERSAL TIME HR MIN SEC	LAT	LONG	DEP	GS MB	AGS Msz	SD	REGION AND COMMENTS
	104853.70	04.226S	134.806E	33N	5.3	5.4	1.1	31 IRIAN JAYA REGION, INDONESIA.
	173450.50	54.801S	118.836W	10G	5.4	5.4	1.2	22 SOUTHERN EAST PACIFIC RISE
21-Mar	091035.50	22.787S	068.418W	03D	5.0		1.1	45 NORTHERN CHILE
22-Mar	072407.70	08.943S	156.373E	33N	5.2	4.9	1.1	28 SOLOMON ISLANDS
	133747.70	04.081S	135.237E	33N	5.1	5.0	1.0	32 IRIAN JAYA REGION, INDONESIA.
	140001.50	18.782S	177.402W	00G	5.0		0.7	30 FIJI ISLANDS REGION
	194330.30	40.987S	173.986E	90G	5.5		1.1	42 COOK STRAIT, NEW ZEALAND.
	200555.40	36.276S	72.878W	43*	5.1		1.0	40 NEAR COAST OF CENTRAL CHILE.
	222432.00	35.977N	139.930E	62	5.0		1.0	61 NEAR S. COAST OF HONSHU, JAP.
	223920.40	21.362S	169.049E	33N	5.4	5.6	0.9	17 LOYALTY ISLANDS REGION. Mw 5.8
23-Mar	020834.50	07.382N	076.699W	10G	5.1	4.9	1.1	68 NORTHERN COLOMBIA. MD 5.2.
	091821.90	36.251S	072.874W	47*	5.2		1.0	43 NEAR COAST OF CENTRAL CHILE.
	101420.70	62.65 S	155.520E	10G	5.4		0.8	7 BALLENY ISLANDS REGION
	175107.90	15.504N	046.621W	33N	5.2	4.3	1.1	19 NORTHERN MID-ATLANTIC RIDGE
24-Mar	041348.50	24.544N	121.887E	63?	5.0		1.1	61 TAIWAN. Felt in northern Taiwan.
	071140.30	24.356S	177.037W	07D	5.4		1.0	48 SOUTH OF FIJI ISLANDS
25-Mar	011301.20	15.996S	74.891W	33N	5.0		1.1	27 NEAR COAST OF PERU
	104216.80	43.100N	147.531E	33N	5.0	4.4	0.9	58 KURIL ISLANDS. Felt (IV) on
	224430.50	10.977S	166.040E	92D	5.8	5.7	0.8	121 SANTA CRUZ ISLANDS. Mw 6.3 (GS).
26-Mar	021614.20	55.861S	028.095W	57D	6.2	5.9	1.2	24 SOUTH SANDWICH ISLANDS REGION.
	052119.10	54.863N	161.404W	33N	5.5	4.8	1.0	174 ALASKA PENINSULA. ML 5.6 (PMR).
	055711.80	54.908N	161.331W	33N	5.3	4.6	1.0	159 ALASKA PENINSULA. ML 5.2 (PMR).
	151230.90	02.153S	079.454W	90D	5.3		0.9	108 NEAR COAST OF ECUADOR. Some
29-Mar	143949.10	42.439S	100.766W	10G	5.3	4.9	0.7	56 SOUTHERN PACIFIC OCEAN (AEIC), 3.6 (PMR).
30-Mar	101436.50	05.405S	151.863E	33N	5.2		0.8	36 NEW BRITAIN REGION, P.N.G.
	181716.00	34.559N	024.929E	10G	5.0		1.0	71 CRETE
	221552.20	44.811N	137.626E	21D	5.2		0.9	178 EASTERN SEA OF JAPAN
2-Apr	052002.00	07.481S	129.428E	57?	4.8		1.6	11 BANDA SEA
3-Apr	115443.00	24.147N	122.216E	33N	5.5	5.5	0.9	18 TAIWAN REGION. Felt on Taiwan.
	154346.00	20.099S	178.805W	623D	5.1		0.9	91 FIJI ISLANDS REGION
	223327.00	24.101N	122.252E	33N	5.1	5.1	1.0	55 TAIWAN REGION
4-Apr	172058.00	06.321N	126.839E	33N	5.4	5.2	1.5	33 MINDANAO, PHILIPPINE ISLANDS
5-Apr	022341.00	14.53 S	168.510E	33N	5.3		0.9	9 VANUATU ISLANDS
	084753.00	06.364S	105.172E	79?	5.1		1.2	12 SUNDA STRAIT
	153911.00	06.331S	147.786E	100	5.3		1.0	18 EASTERN NEW GUINEA REG., P.N.G.
	204748.00	10.946N	126.004E	33N	5.1	4.9	0.8	43 PHILIPPINE ISLANDS REGION
7-Apr	022049.00	00.219S	124.588E	33N	4.9		1.1	19 SOUTHERN MOLUCCA SEA
	220657.00	15.193S	173.622W	31G	6.7	8.0	0.9	72 TONGA ISLANDS. Mw 7.5 (GS), 7.5
8-Apr	010207.00	15.169S	173.498W	33N	5.0		0.7	41 TONGA ISLANDS
	012007.00	15.227S	173.521W	33N	5.9	6.1	0.8	31 TONGA ISLANDS
	062101.00	00.504S	124.217E	33N	5.0	4.9	1.1	43 SOUTHERN MOLUCCA SEA
	142837.00	15.260S	173.377W	33N	5.5	5.3	0.8	90 TONGA ISLANDS. Mo=2.6*10**17 Nm
	163535.00	15.274S	173.515W	33N	5.2	5.5	0.8	67 TONGA ISLANDS. Mo=2.1*10**17 Nm
	171253.00	15.329S	173.416W	33N	5.3	5.4	0.6	60 TONGA ISLANDS
	173840.00	21.613S	170.069E	118*	5.1		0.8	28 LOYALTY ISLANDS REGION
	174518.00	21.825N	142.640E	319D	6.3		0.9	7 MARIANA ISLANDS REGION. Mw 6.3
	191352.00	52.195N	159.135E	33N	5.6	5.1	0.8	38 OFF EAST COAST OF KAMCHATKA
	224502.00	03.116N	127.155E	33N	5.1	5.0	1.1	37 TALAUD ISLANDS, INDONESIA
9-Apr	030120.00	06.369S	127.943E	365*	4.9		0.7	10 BANDA SEA
	044449.00	21.814N	121.173E	33N	5.2	4.7	1.0	83 TAIWAN REGION
	063554.00	00.033S	126.565E	64*	5.2		1.1	43 SOUTHERN MOLUCCA SEA. Felt (III)
	093219.00	04.627S	153.195E	33N	4.8		1.0	41 NEW IRELAND REGION, P.N.G.
10-Apr	031114.00	30.389N	130.693E	33N	5.1	4.8	0.9	77 KYUSHU, JAPAN. Felt (III JMA) at
	105939.00	10.068S	154.501E	33N	4.8	4.5	1.1	19 D'ENTRECASTEAUX ISLANDS REGION
11-Apr	213308.00	27.816S	176.966W	33N	5.1	5.3	1.1	35 KERMADEC ISLANDS REGION
12-Apr	080443.00	01.910N	127.120E	121*	5.0		0.3	11 HALMAHERA, INDONESIA
	182232.00	02.665N	078.330W	43	5.2		0.9	73 NEAR WEST COAST OF COLOMBIA

APPENDIX 1 - Participants in the TASGO Refraction/tomography survey

Survey Design

B. Drummond, B. Goleby, T. Yeates, C. Collins, E. Chudyk (AGSO)
R. Richardson (Tasmanian Geological Survey)

Deployment of Recording Stations

E. Chudyk, R. Bracewell, B. Devenish, and members of the Land Seismic crew (AGSO)
S. Hayward (Tasmanian Geological Survey)

Tasmanian Observatory Network digital data acquisition

V. Jensen, J. Pongratz (University of Tasmania)
G. Self (University of Western Australia)
V. Dent (AGSO, Mundaring Observatory WA)

Helicopter and Fixed-wing Aircraft Support

A Brown, J Pemberton, R. Richardson (Tasmanian Geological Survey)
R. Williams and pilots (Helicopter Resources)
F. Bender (King Aviation)
H. Innes (Heather Aviation Services)

Field Support

G. Richardson, D. Robson and W. Barry (Forestry Tasmania)
E. Williams (North Forests)

Quarry Blasts

M. McBain (David Mitchell Ltd - Tel 003 631188)
D. Taylor (Boral Quarries, Beaconsfield - Tel 003 831355)
H. Bohannon (Copper Mines of Tasmania - Tel 004 711666)
C. Johnston (Savage River Mining - Tel 004 463219)
P. Williams (Boral, Launceston - Tel 003 261238)
D. Jones (Boral Resources, Tasmania - Tel 002 637211)
G. Newling and T. Manger (Aberfoyle Resources - Tel 004 392222)
P. Merrick (Henty Gold Project, RGC- Tel 004 732444)

Refraction Shots

D. Eaton, A. Porter, S. Pardalis, R. Bracewell (AGSO)

Rig Seismic Shipboard Operations

P.J. Hill, K. Webber and Survey 148/159 Shipboard Party (AGSO)
R. Hardinge (Master) and crew of the *Rig Seismic* (Australian Marine Safety Authority)

APPENDIX 2 - Refraction Shots at Strickland

Shot 1

Time: 8/3/95 09:19:02.810 Local Time¹

No. of Hole	Charge (kg)	No. of Dets.	Depth to top of Charge (m)
1	100	3	22.0
2	100	3	17.0
3	100	3	18.5
4	100	4	14.4
5	100	3	22.2
6	100	3	21.7
6	600	19	

Shot 2

Time: 8/3/95 09:40:08.674 Local Time¹

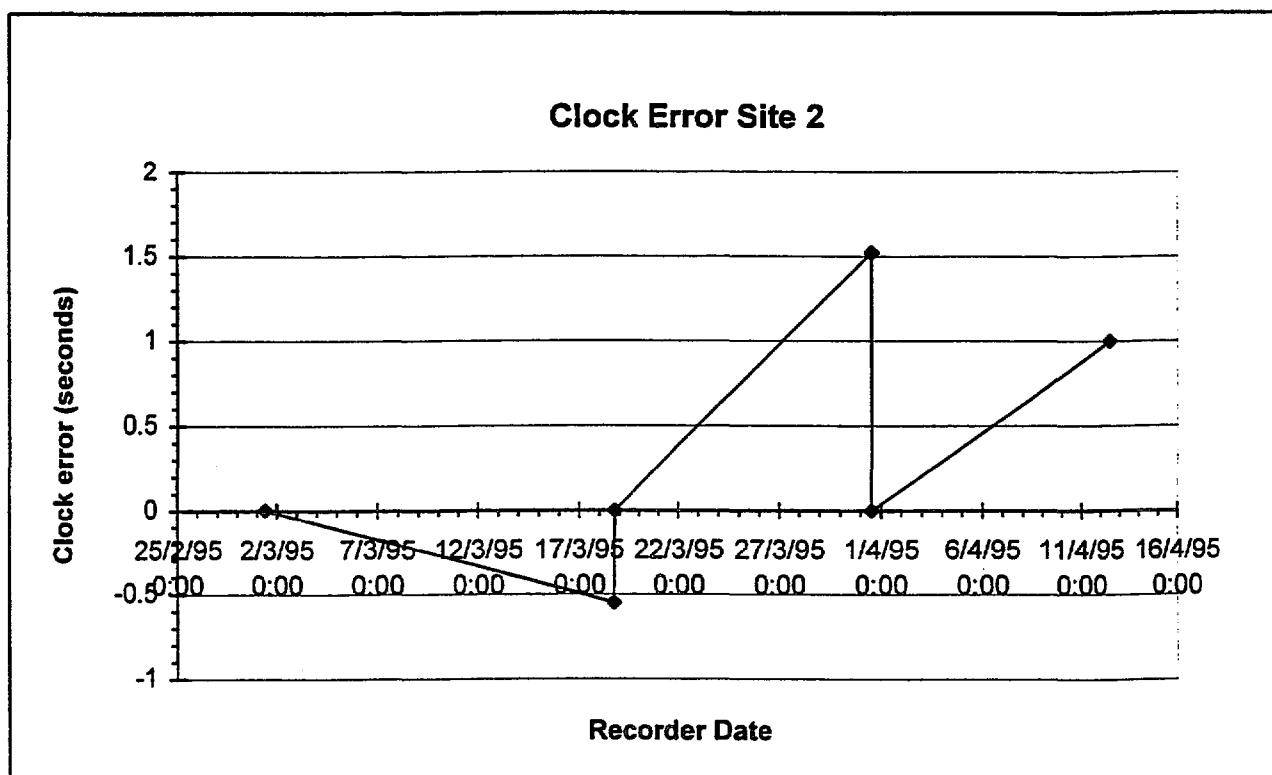
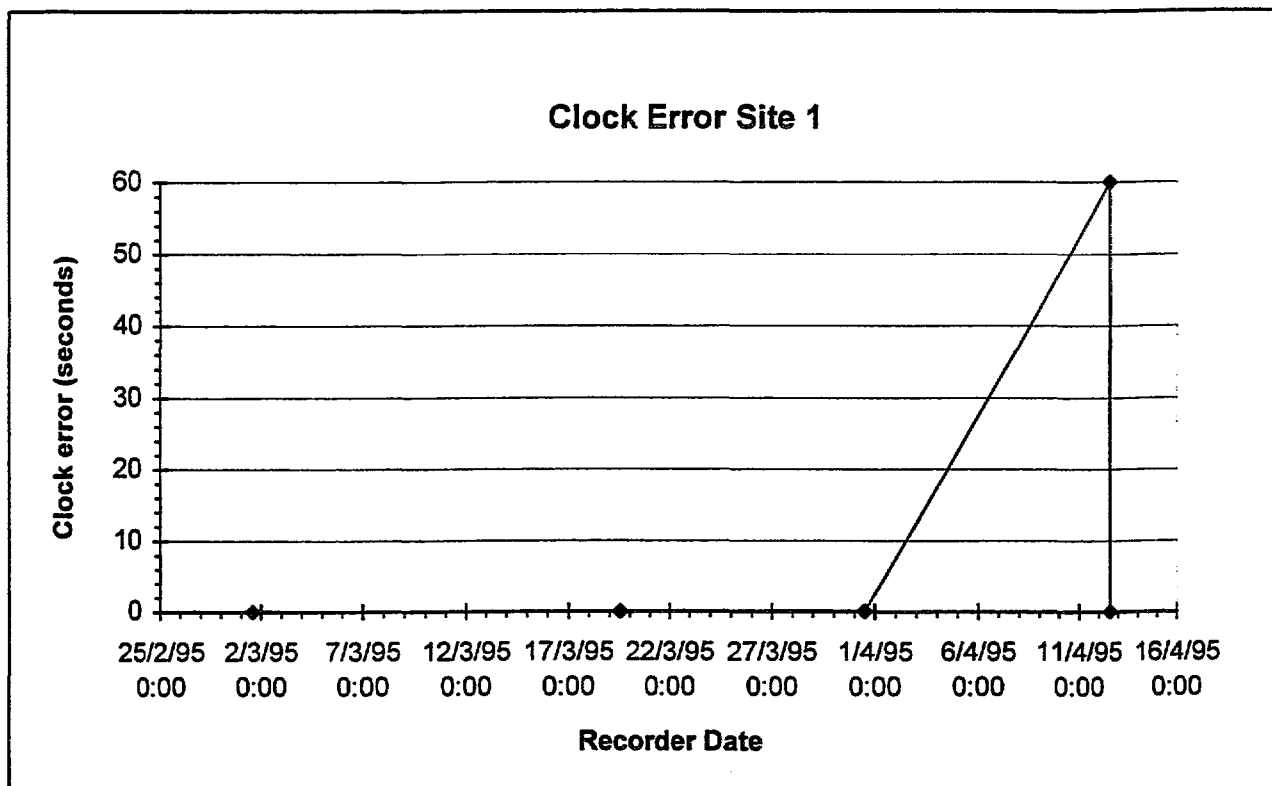
No. of Hole	Charge (kg)	No. of Dets.	Depth to top of Charge (m)
7	100	3	20.8
8	100	3	20.0
9	100	3	21.9
10	100	3	21.1
11	100	3	22.4
12	100	3	21.9
13	84	3	24.3
14	84	3	23.9
15	84	3	23.2
16	60	3	22.6
10	912	30	

Note: 1) The timing geophone was approximately 30 m from the centre of the shot pattern.
These shot times are not corrected for this distance.

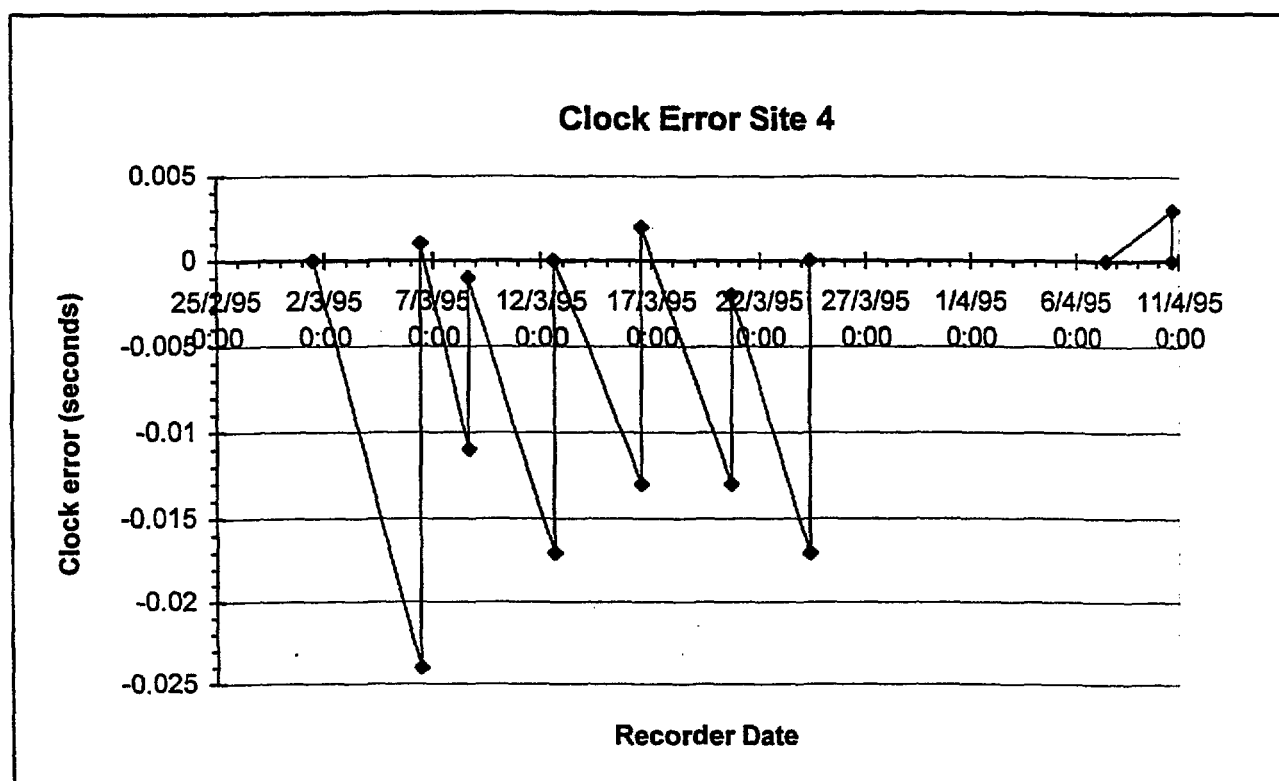
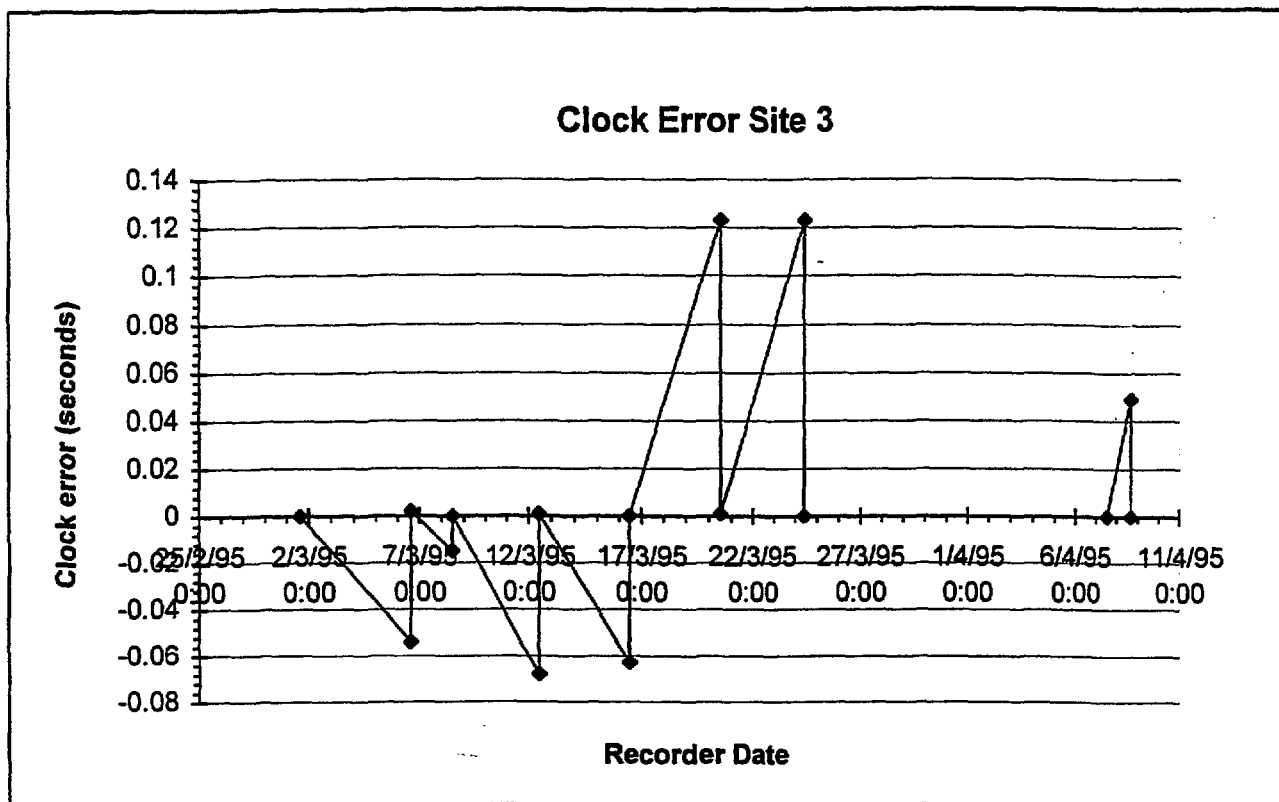
APPENDIX 3 - Quarry Blasts

DATE 1995	TIME	QUARRY	CHARGE SIZE (KG)	COMMENTS
9/3	15:00	Savage River Mine	19,360	Both shots fired simultaneously
	15:00	Savage River Mine	16,950	
14/3	12:45	Savage River Mine	16,880	
19/3	16:00	Savage River Mine	27,470	
14/3	12:00	Boral Launceston	2,350	
08/3	12:00	Boral	1,479	Bench 3
14/3	12:00	Boral	2,594	Bench 1
17/3	12:00	Boral	1,535	Bench 1
09/3	16:00	Aberfoyle, Hellyer Mine	3,686	(4,922 tonnes dirt)
14/3	08:00	Aberfoyle, Hellyer Mine	2,798	(10,997 tonnes dirt)
09/3	-	Henty Mine	65 gm	powergel (charge size needs checking?)
13/3	-	Henty Mine	160 gm	
9/3	-	David Mitchell, Mole Ck	170	
14/3	-	David Mitchell, Mole Ck	155	
28/3	-	David Mitchell, Mole Ck	170	(Predicted blast)
8/3	03:30	Copper Mines, Mt Lyell	130 (approx)	
09/3	12:30,	Copper Mines, Mt Lyell	130 (approx)	Also 16:45,11:15
10/3	07:00	Copper Mines, Mt Lyell	130 (approx)	Also 13:00
12/3	14:30	Copper Mines, Mt Lyell	130 (approx)	
13/3	00:15	Copper Mines, Mt Lyell	130 (approx)	Also, 06:30, 16:00
14/3	11:15	Copper Mines, Mt Lyell	130 (approx)	
15/3	01:30	Copper Mines, Mt Lyell	130 (approx)	Also 07:00
16/3	01:00	Copper Mines, Mt Lyell	130 (approx)	Also 13:20, 20:15
17/3	02:30	Copper Mines, Mt Lyell	130 (approx)	Also 10:15,17:30,23:30

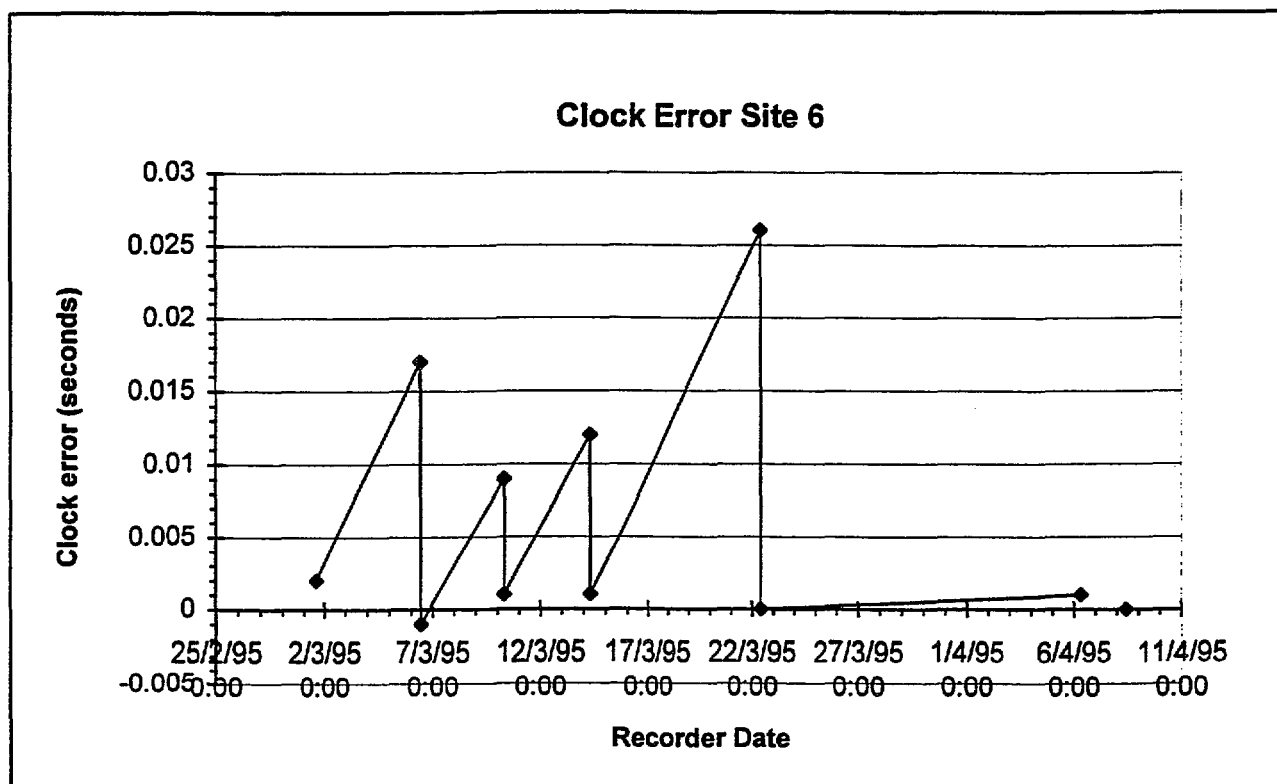
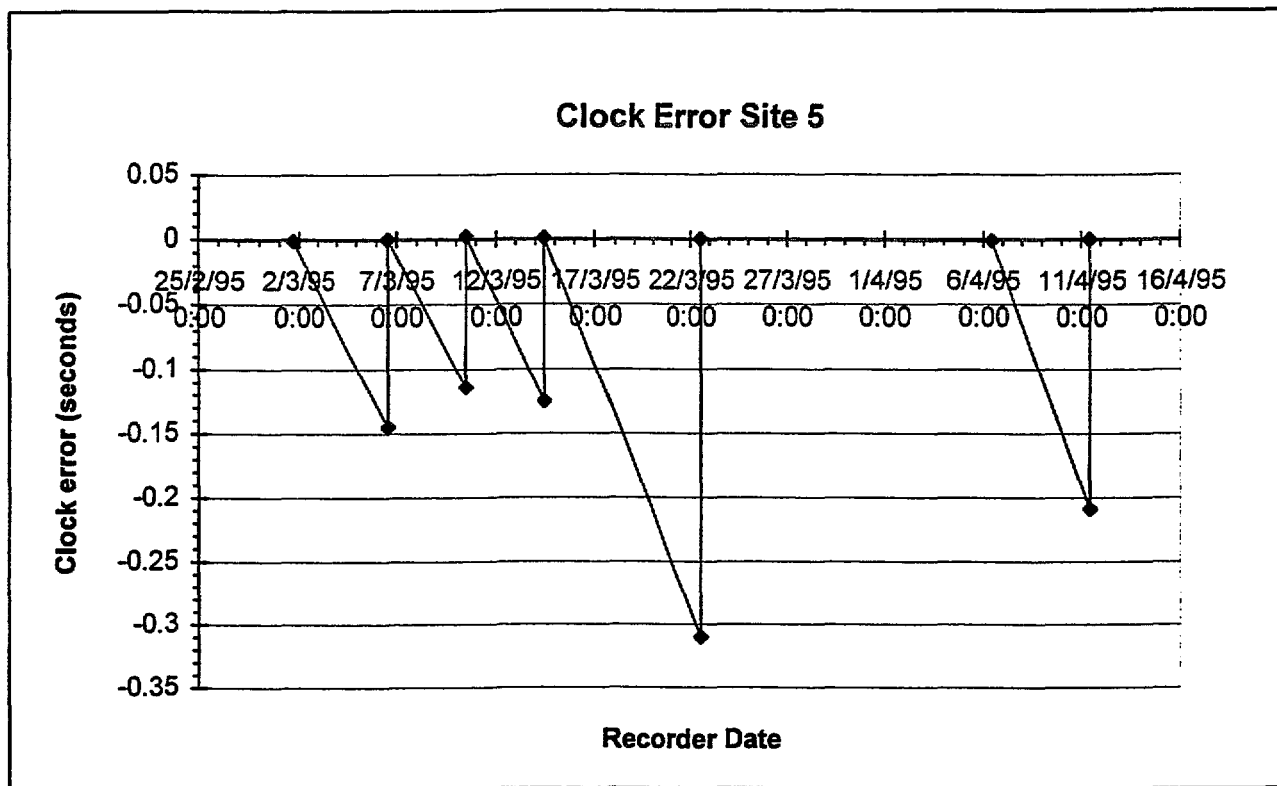
APPENDIX 4 - Station Clock Drifts



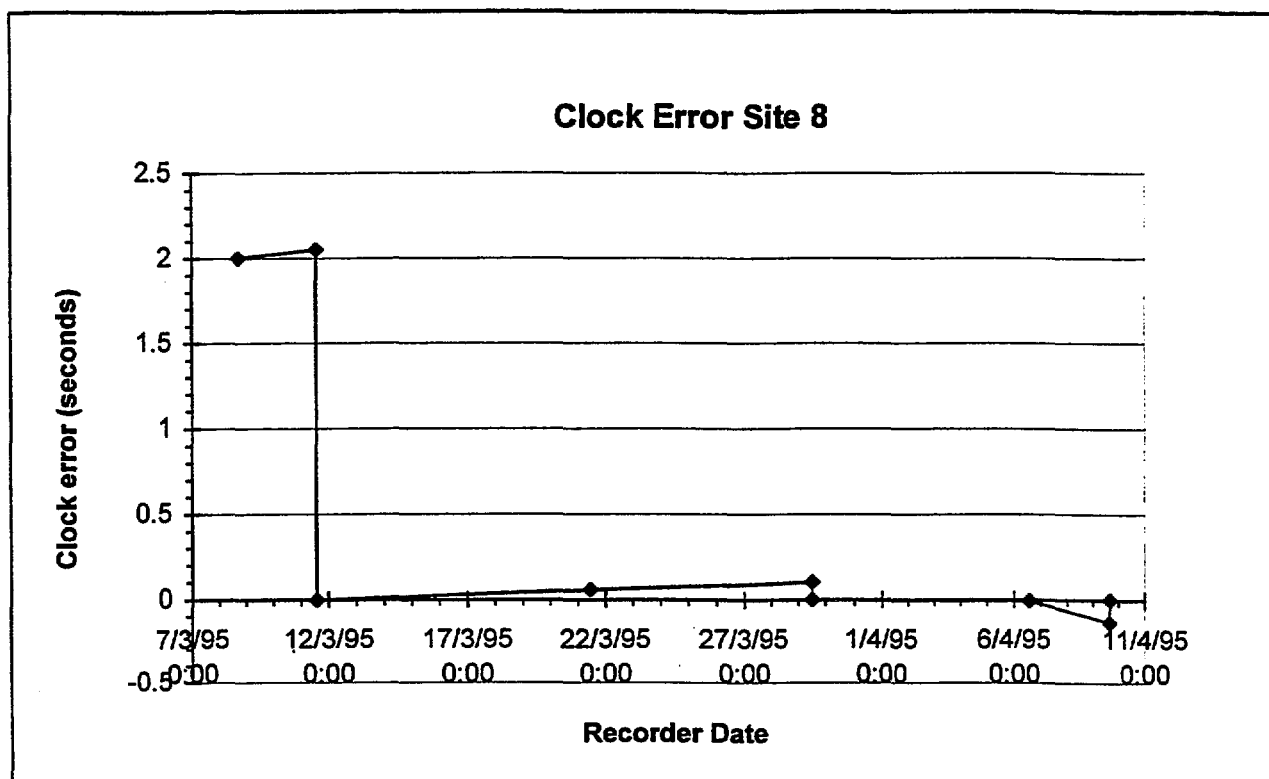
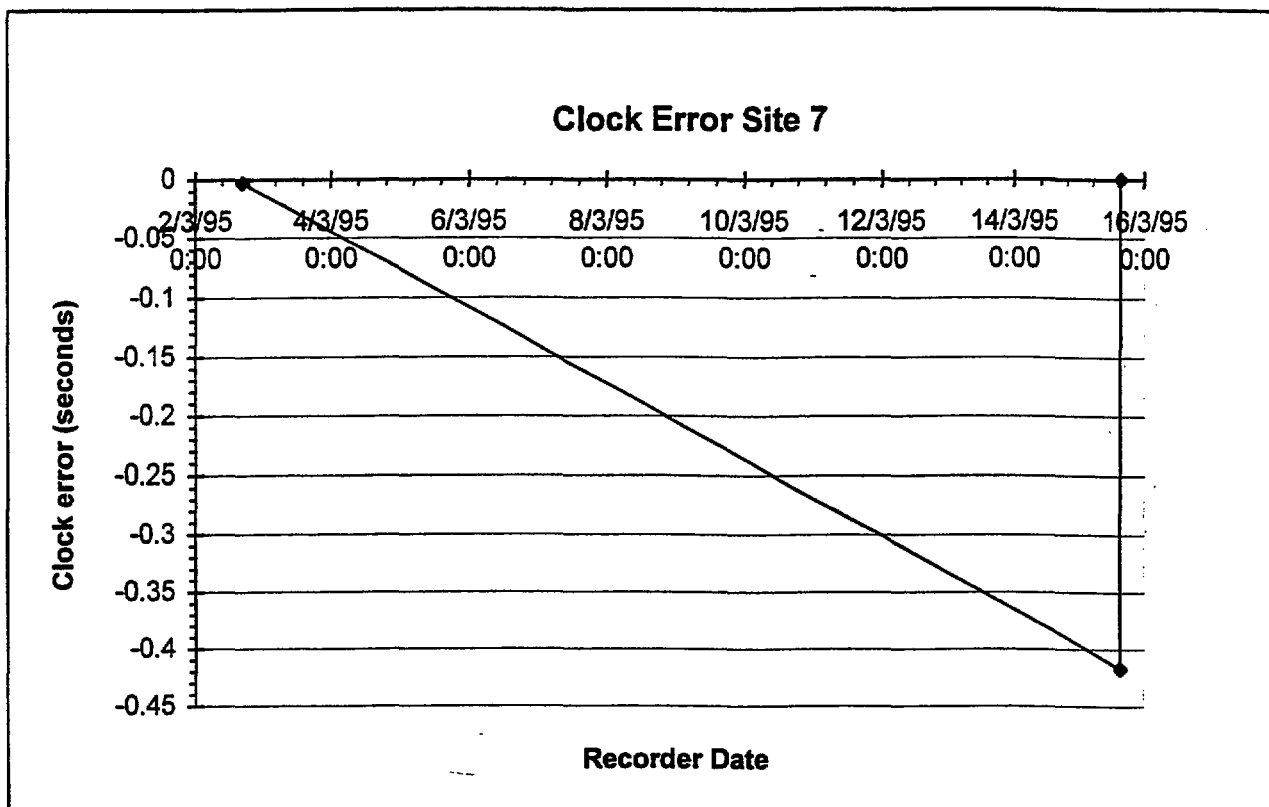
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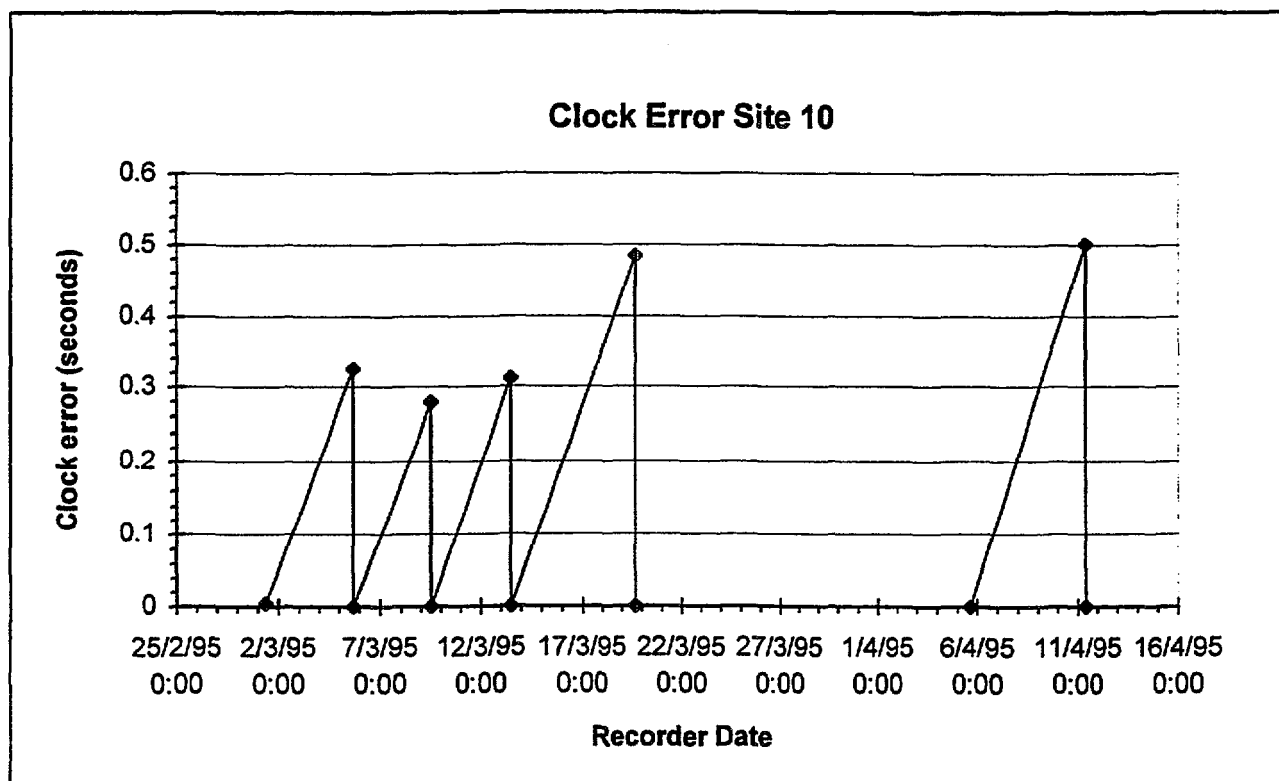
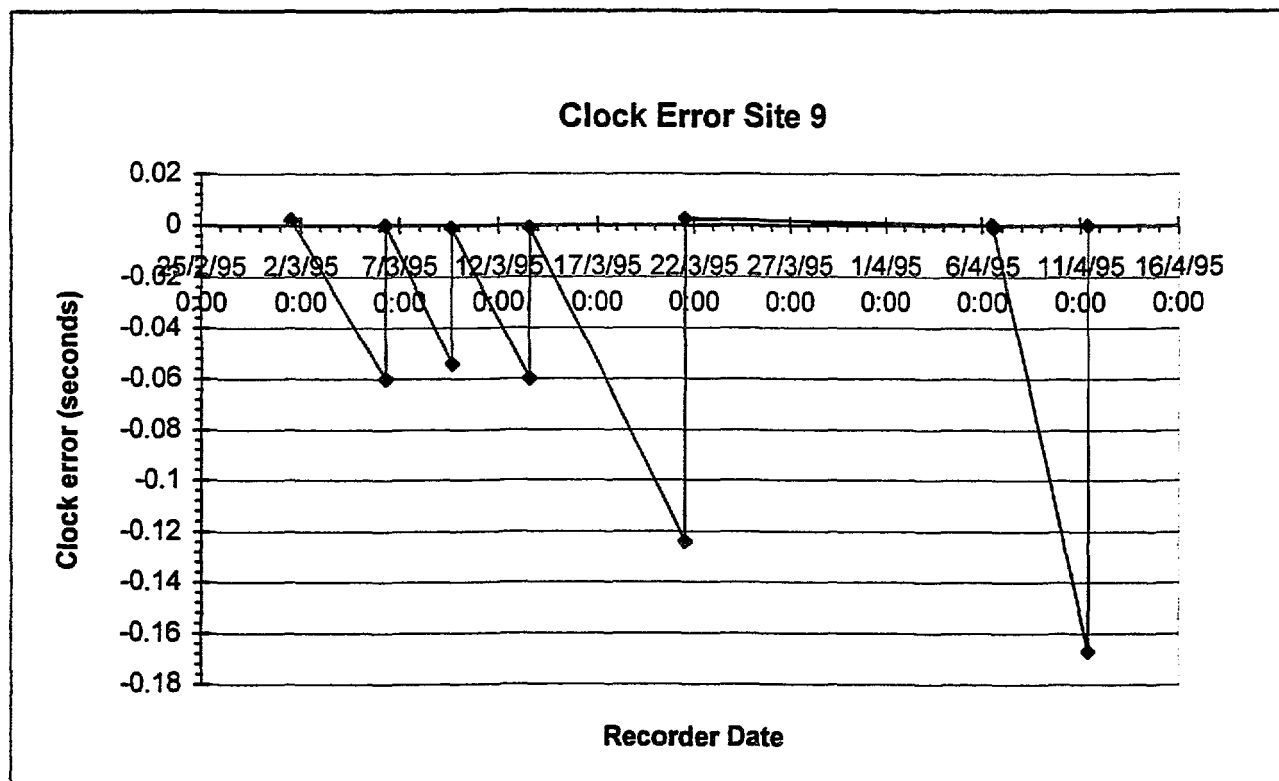
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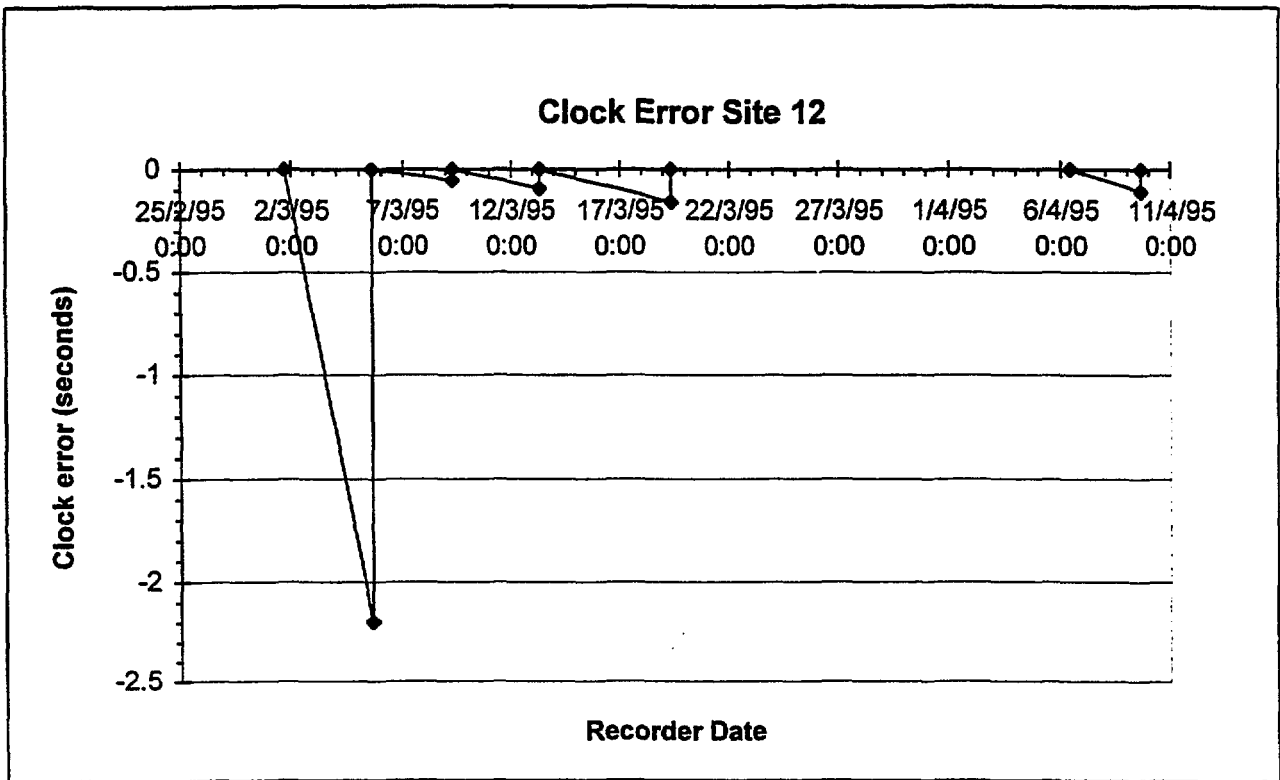
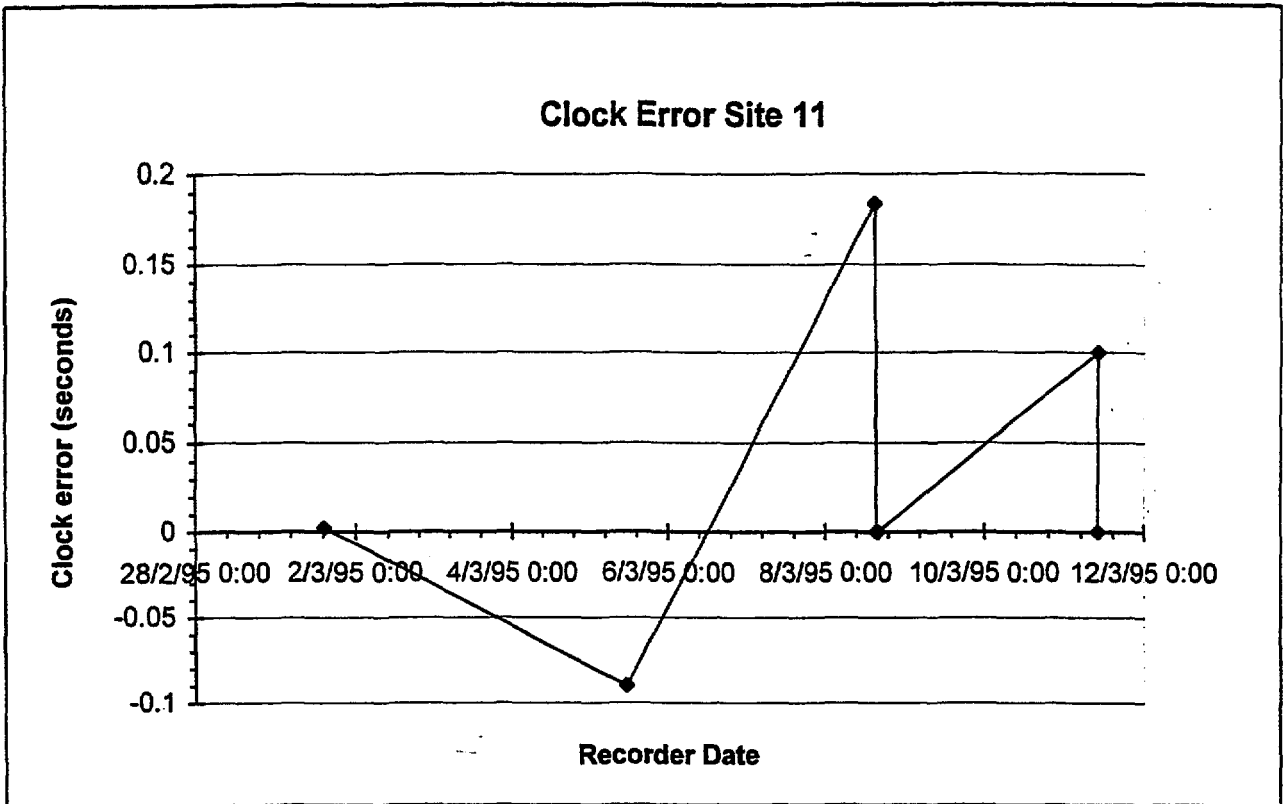
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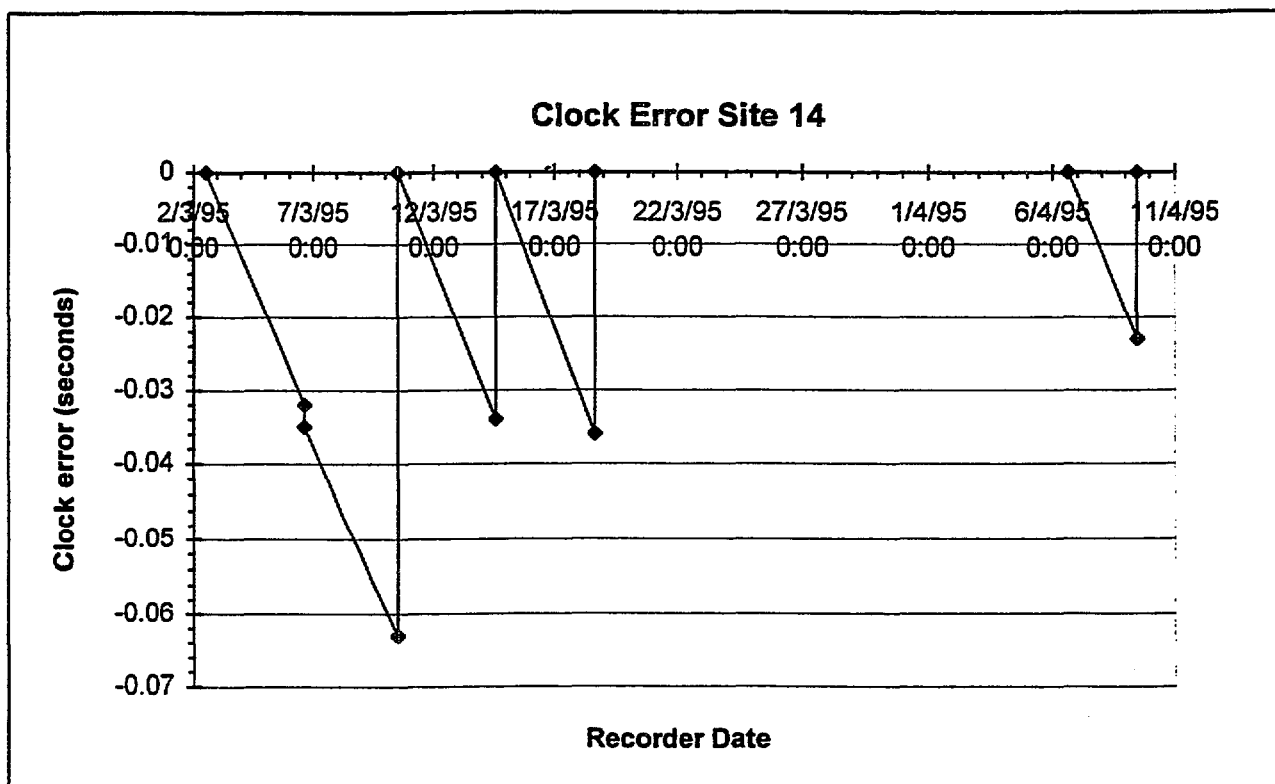
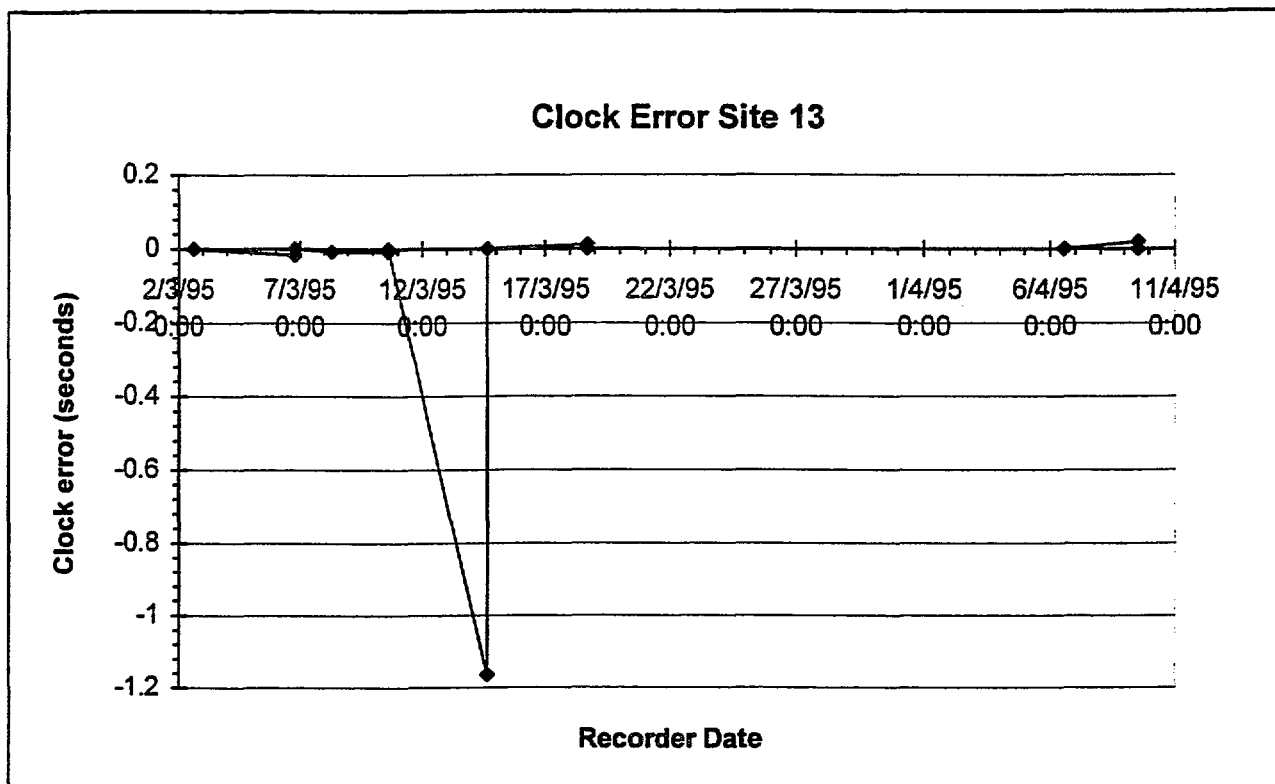
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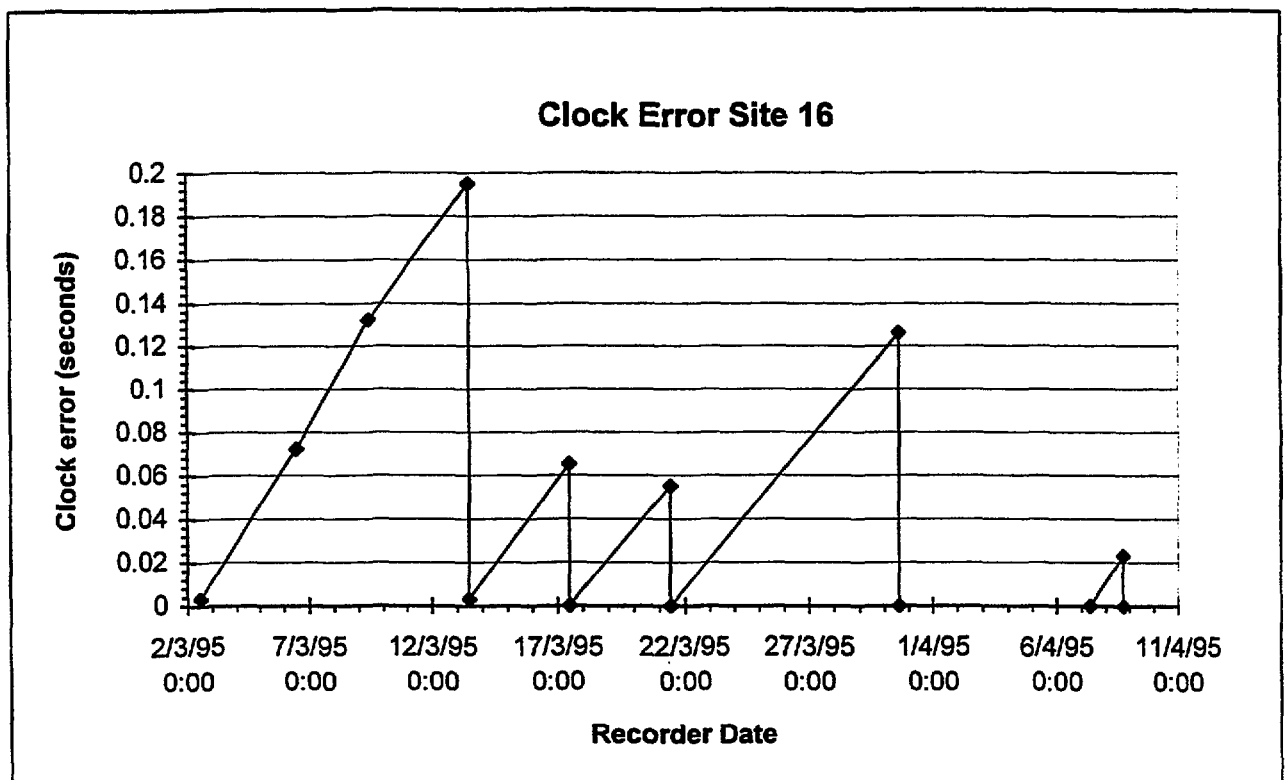
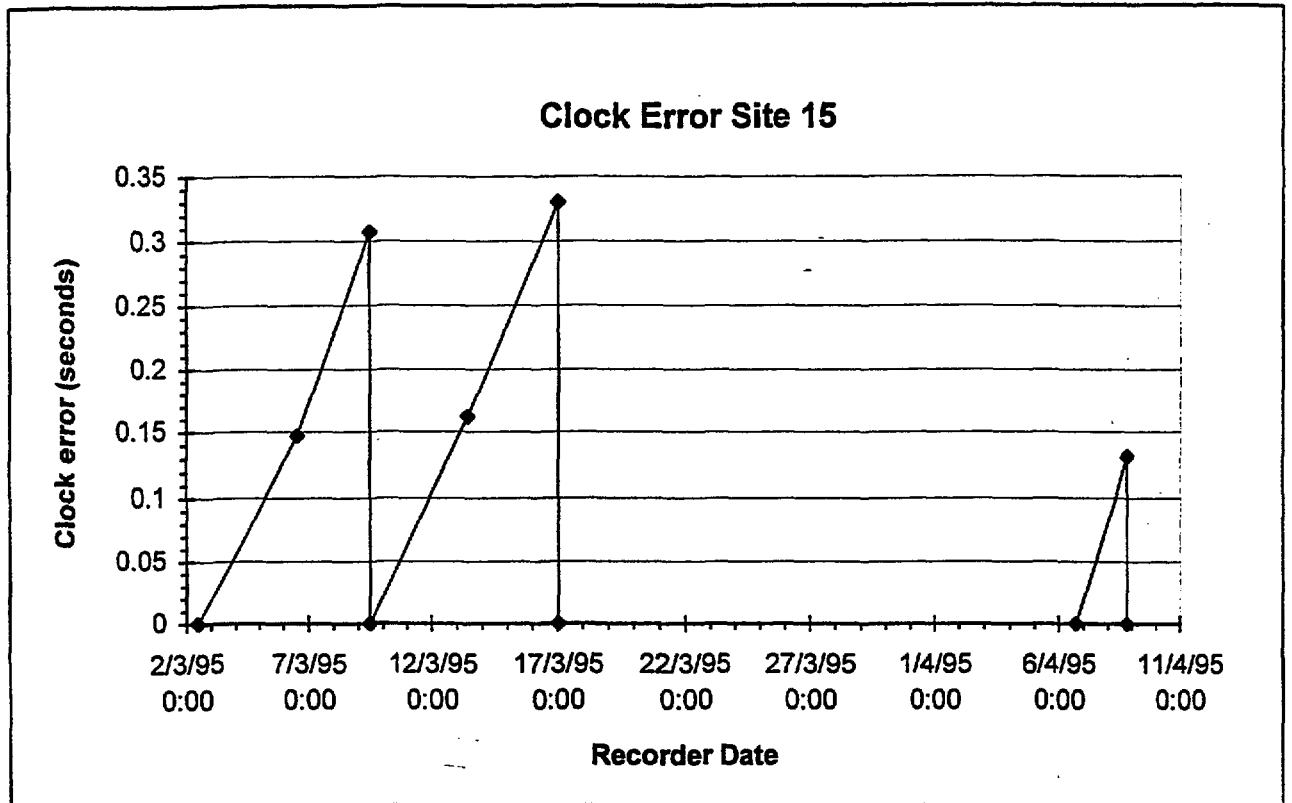
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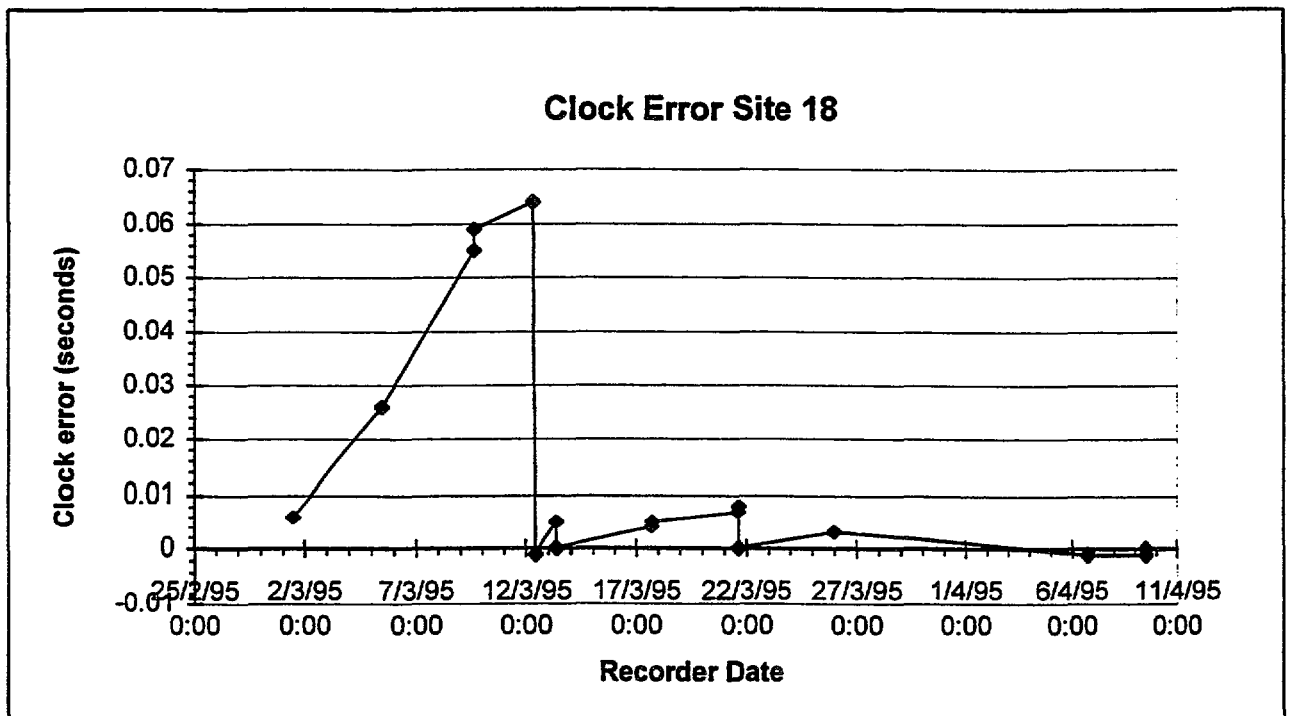
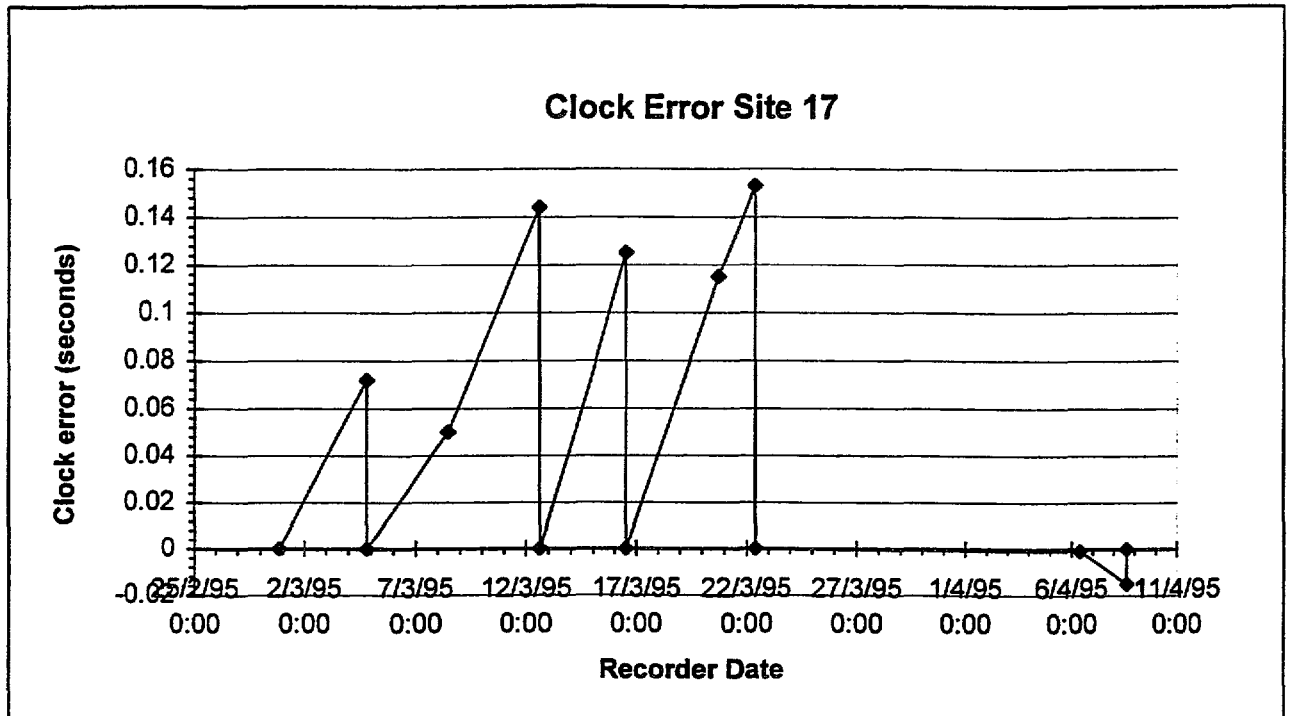
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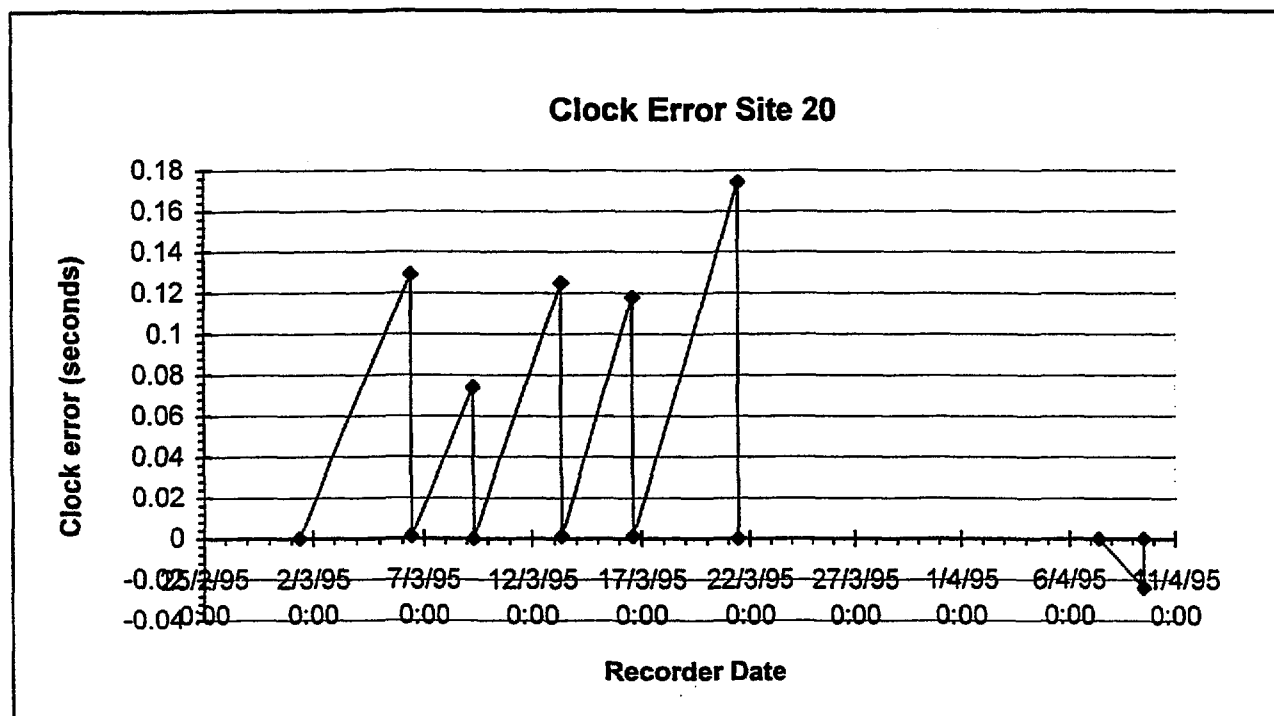
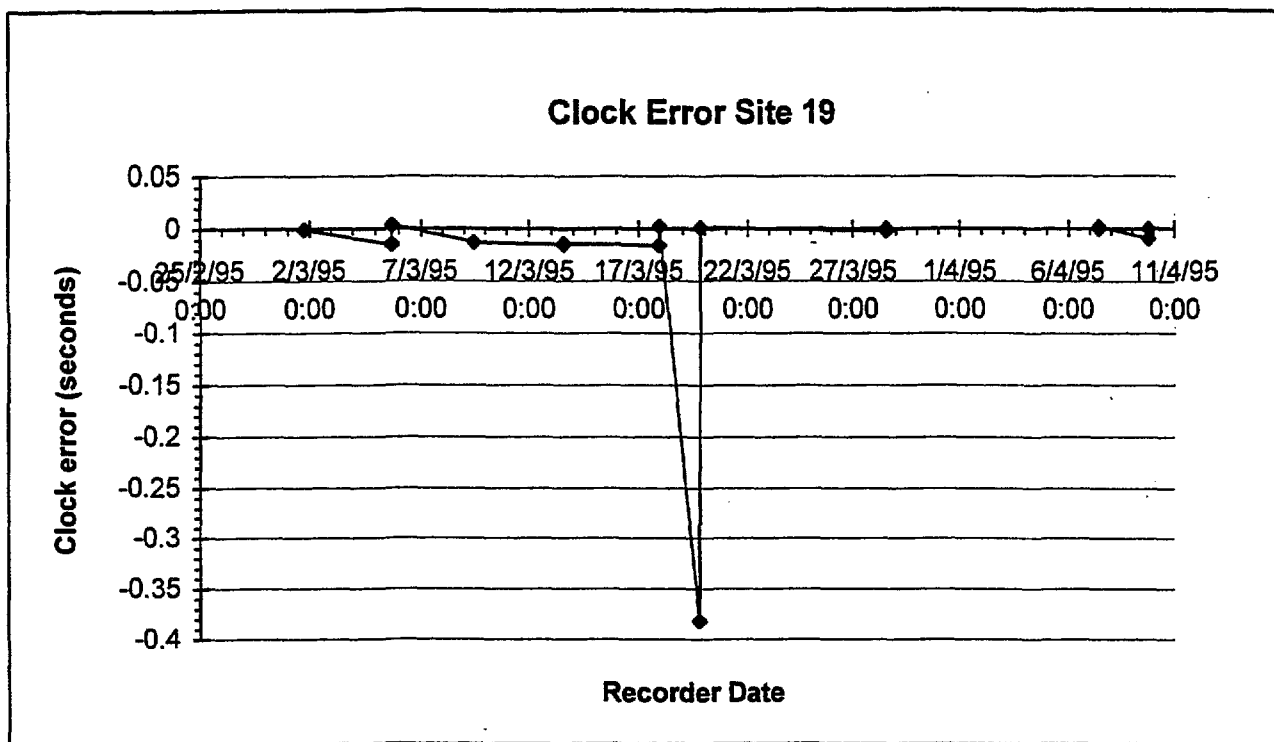
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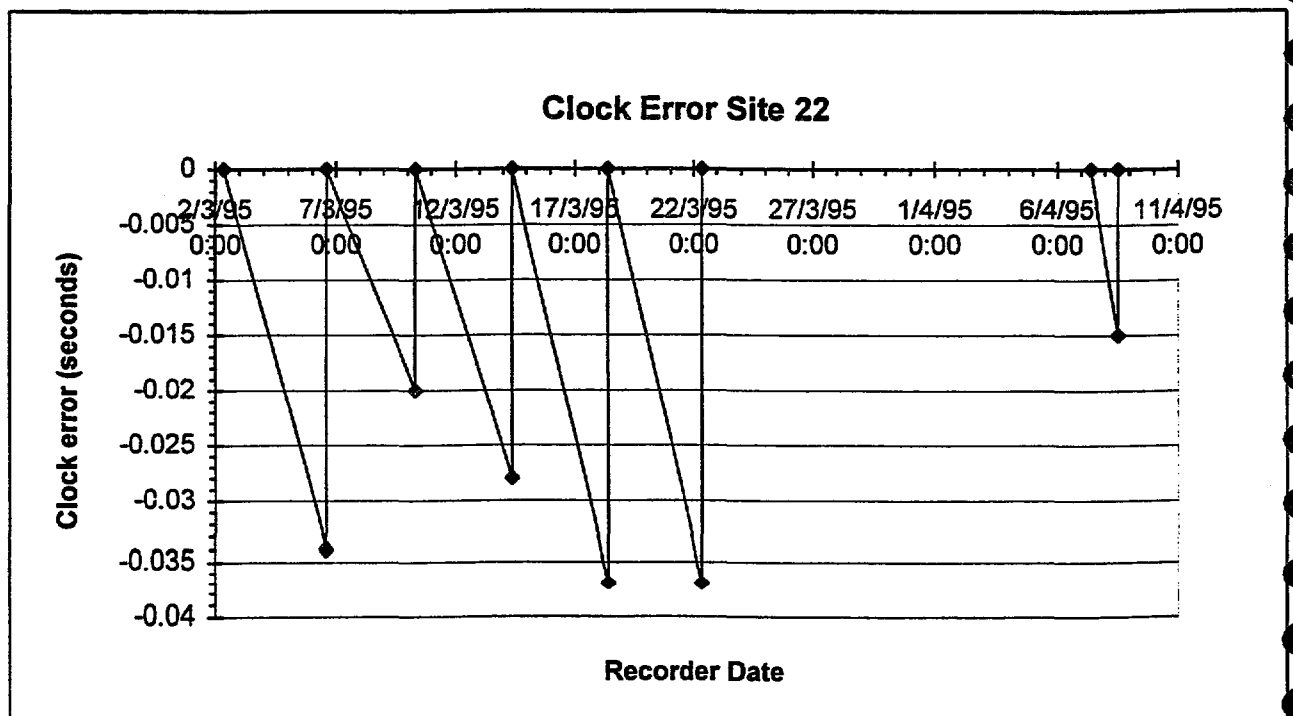
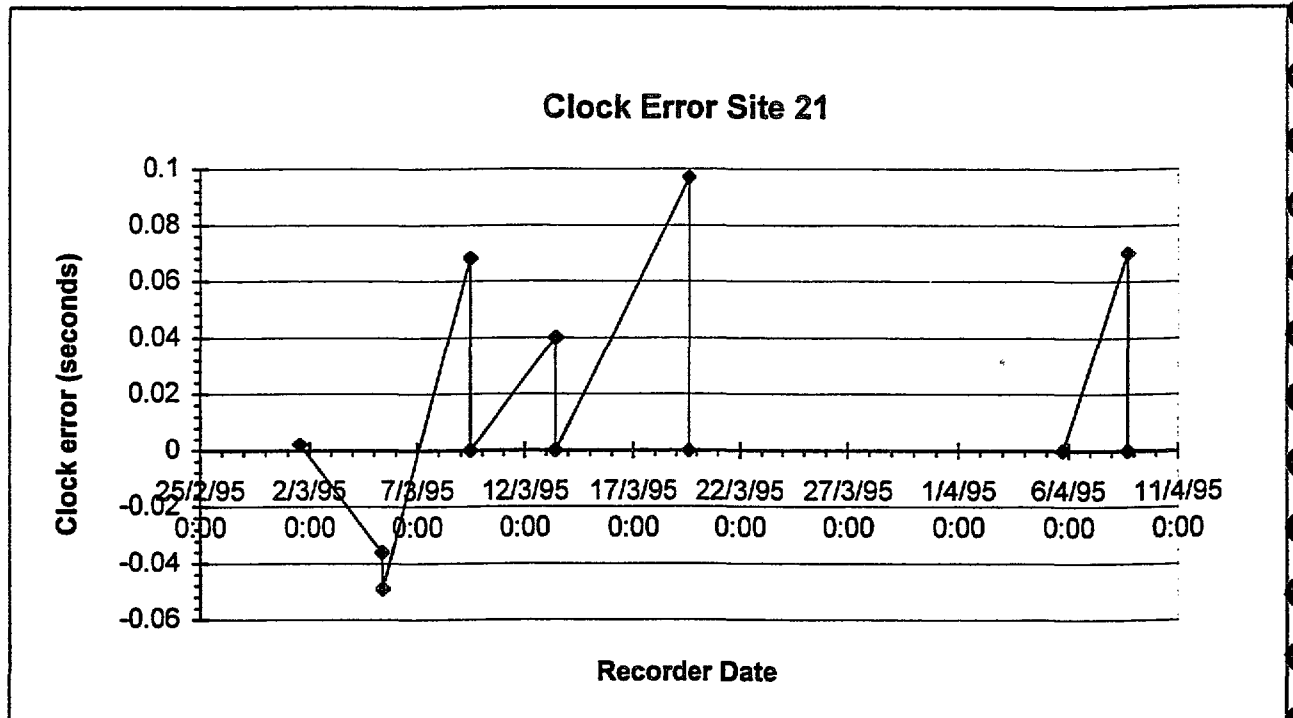
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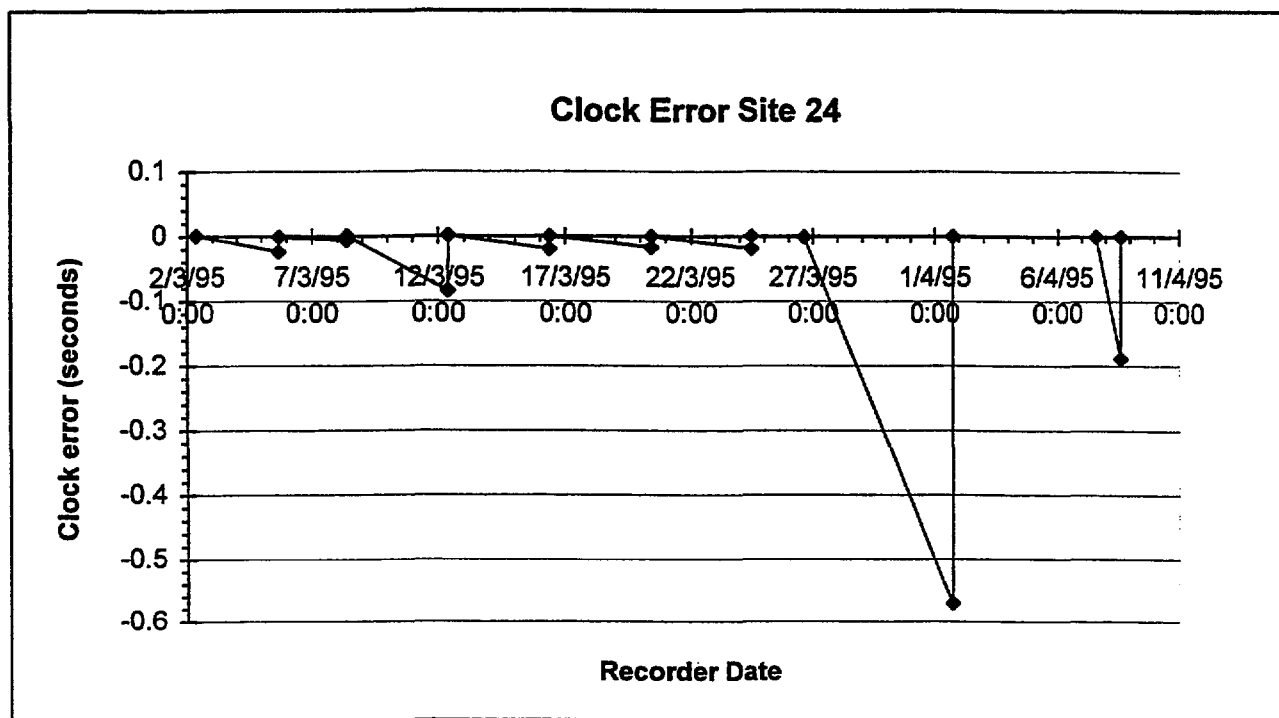
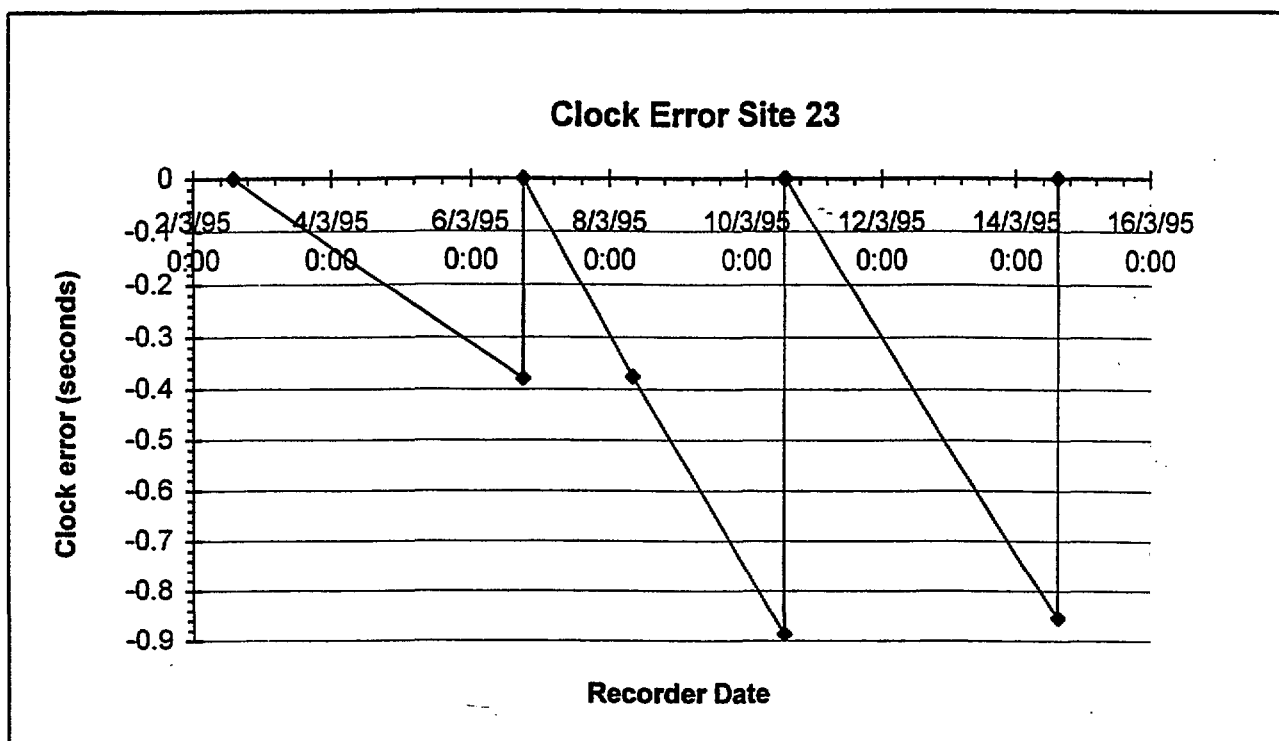
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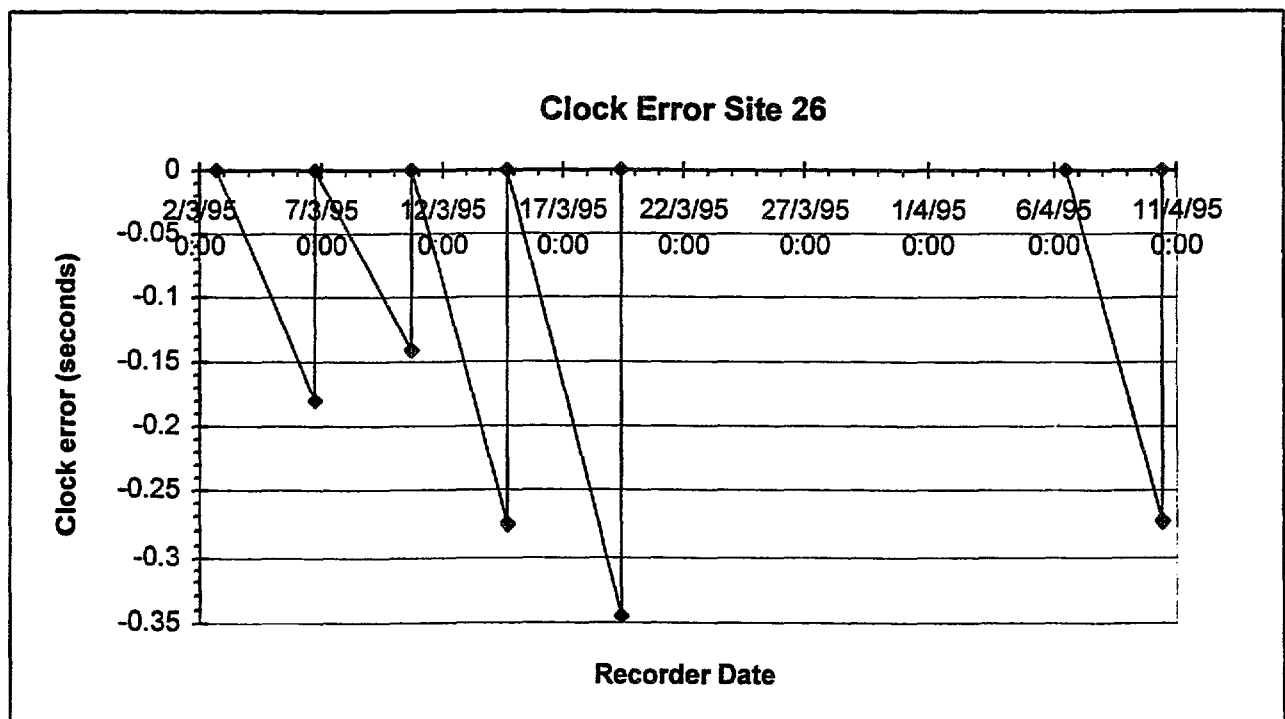
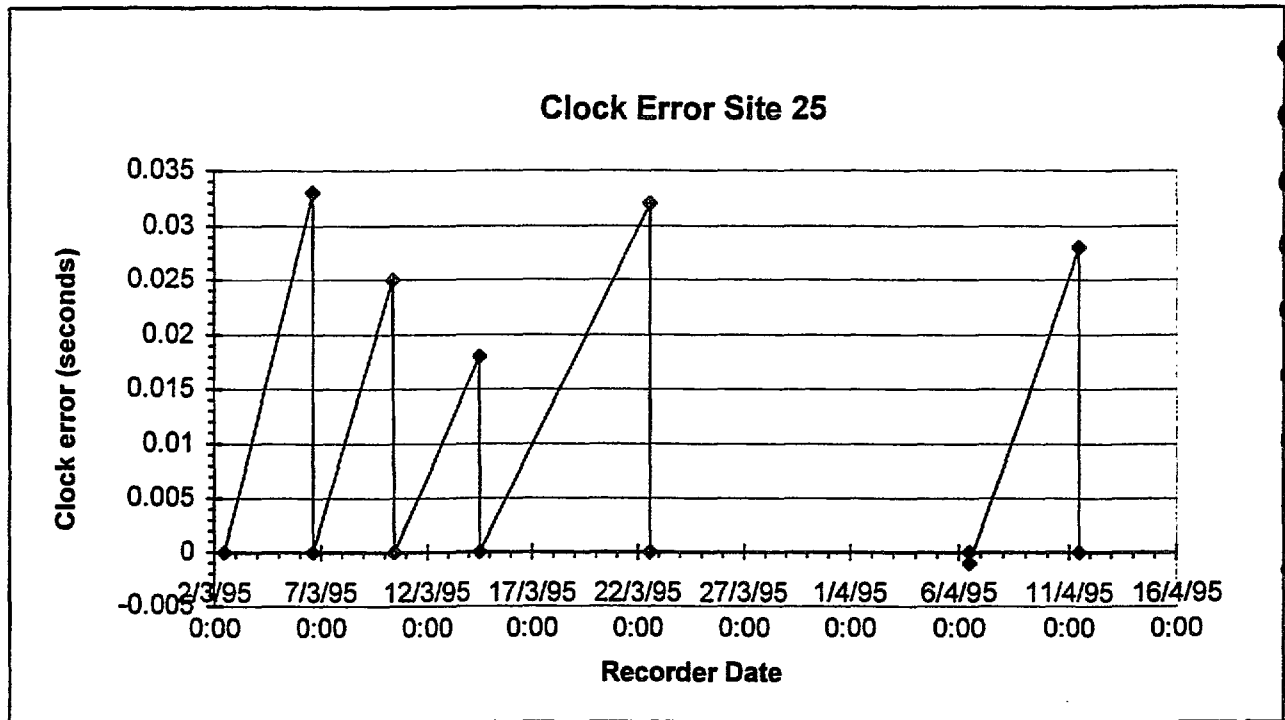
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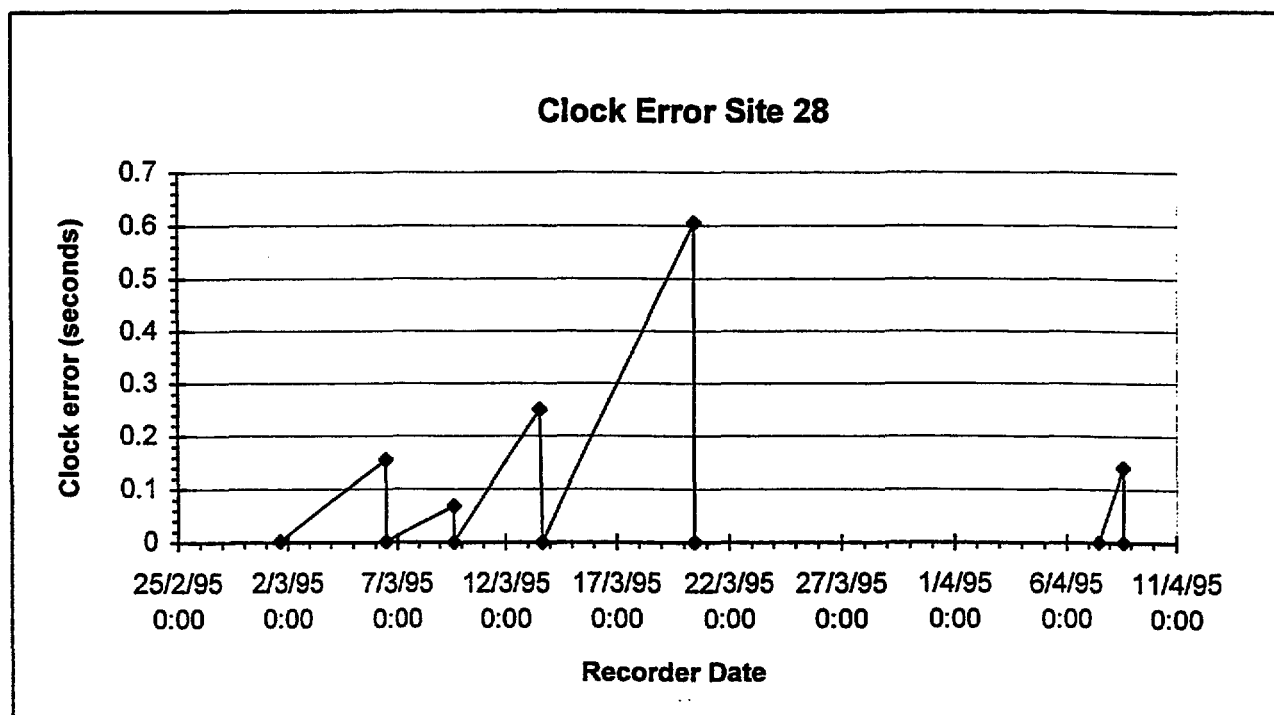
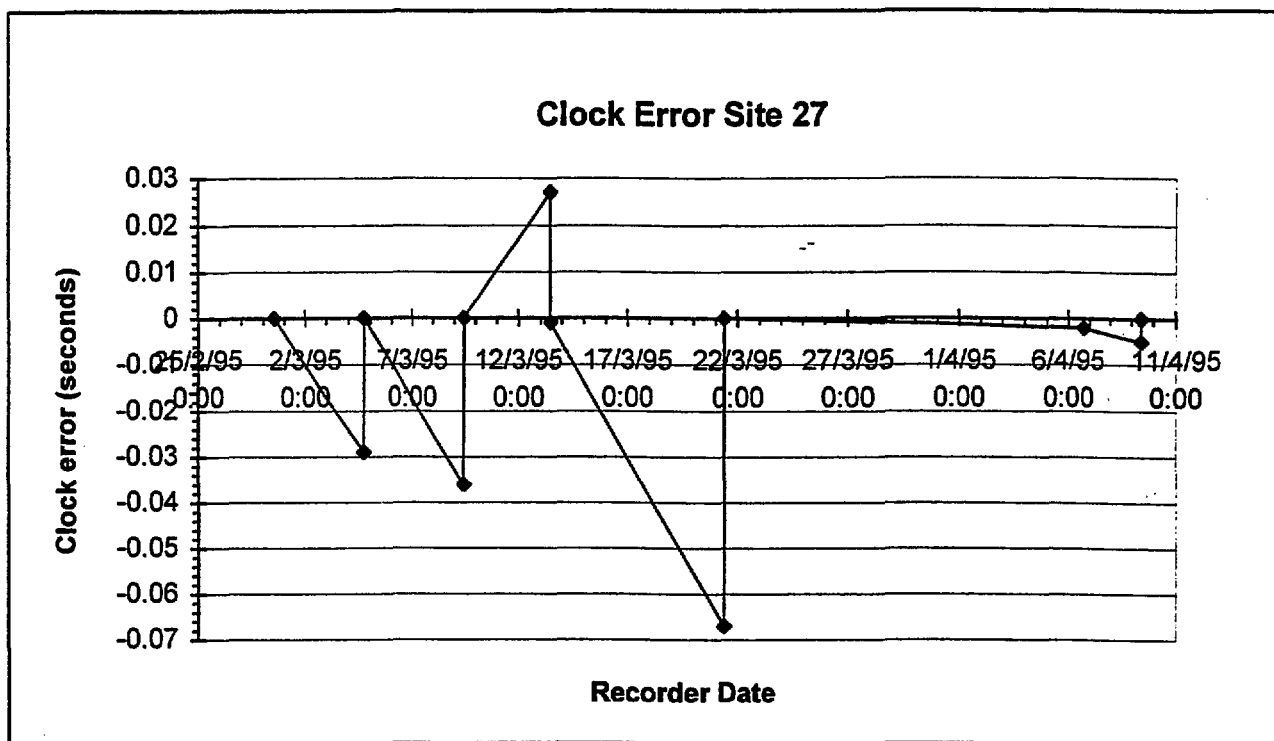
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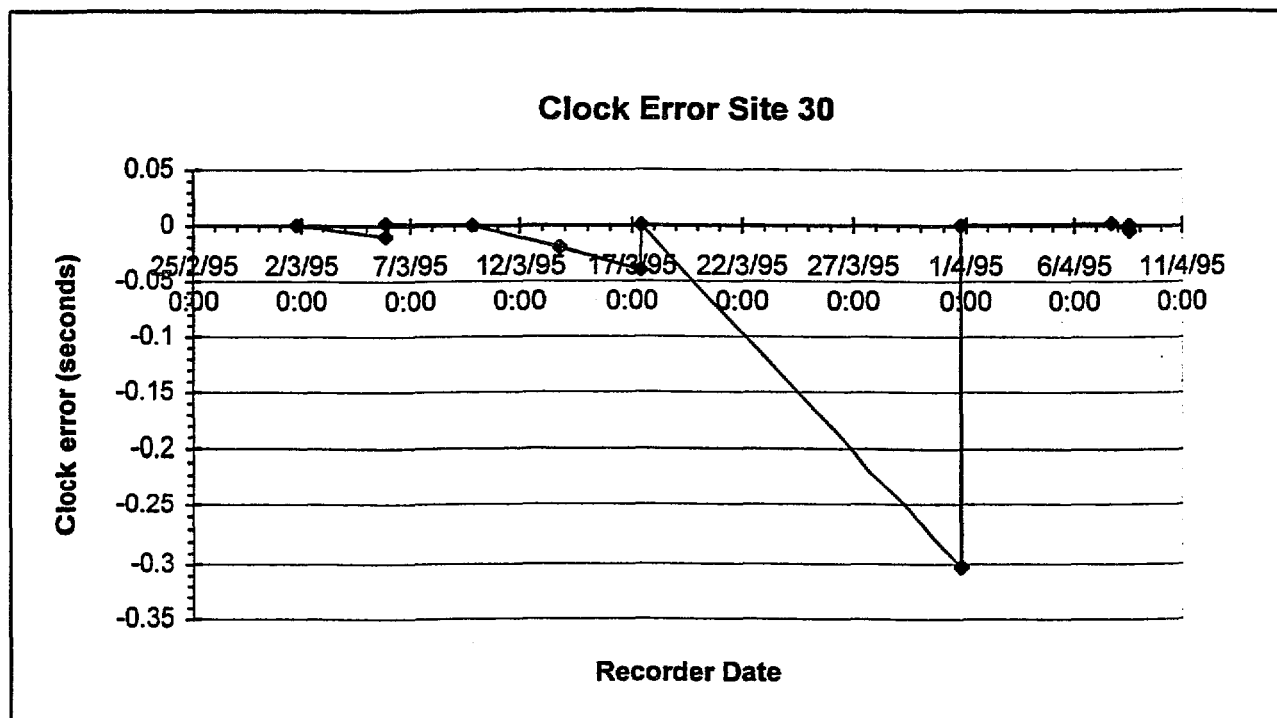
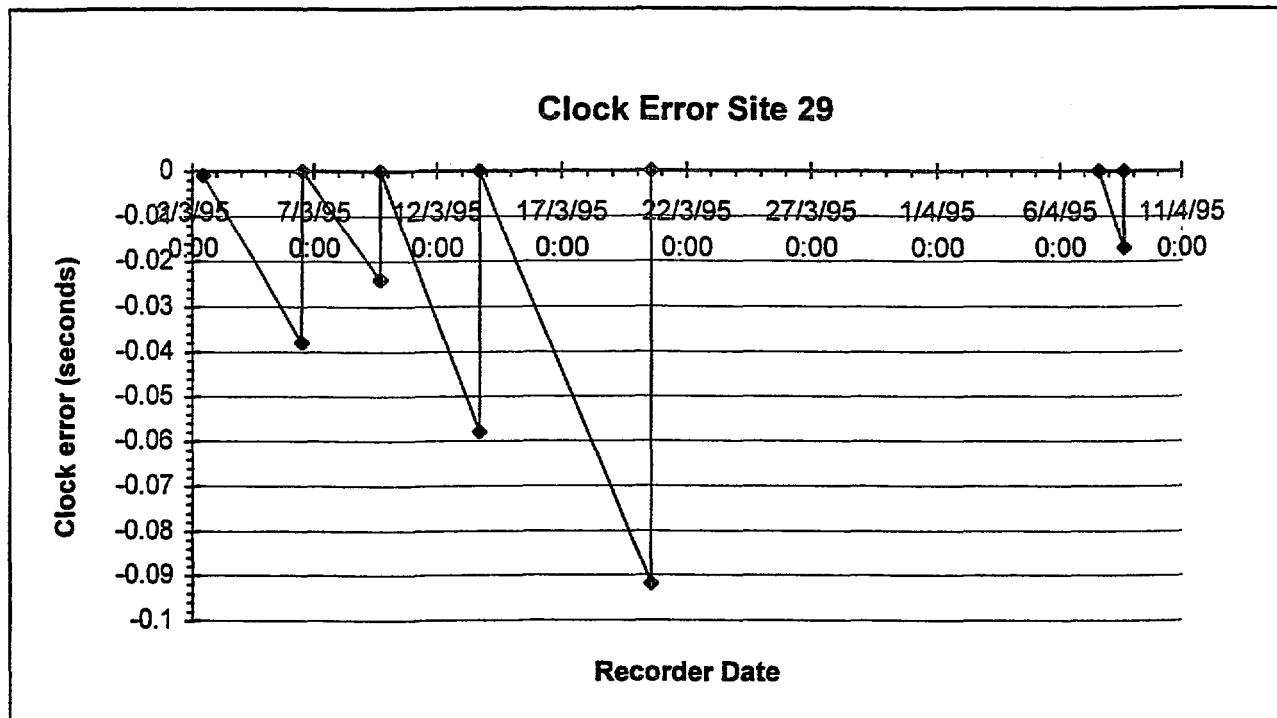
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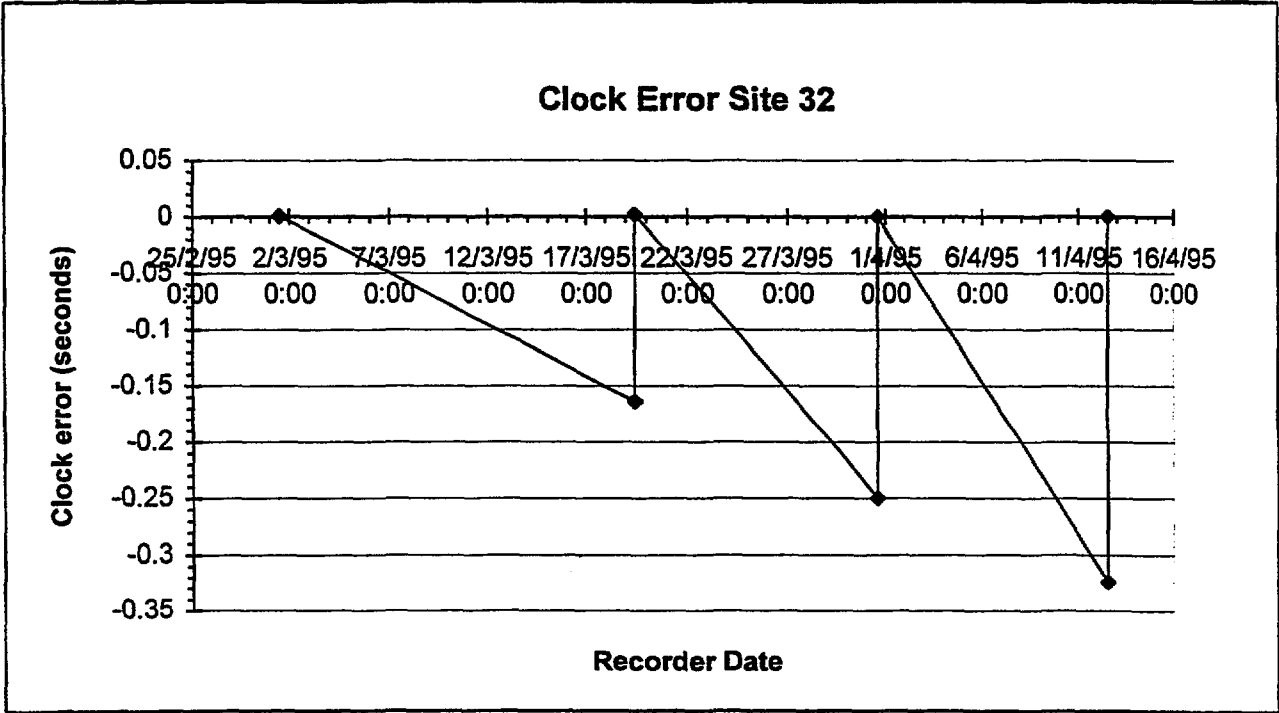
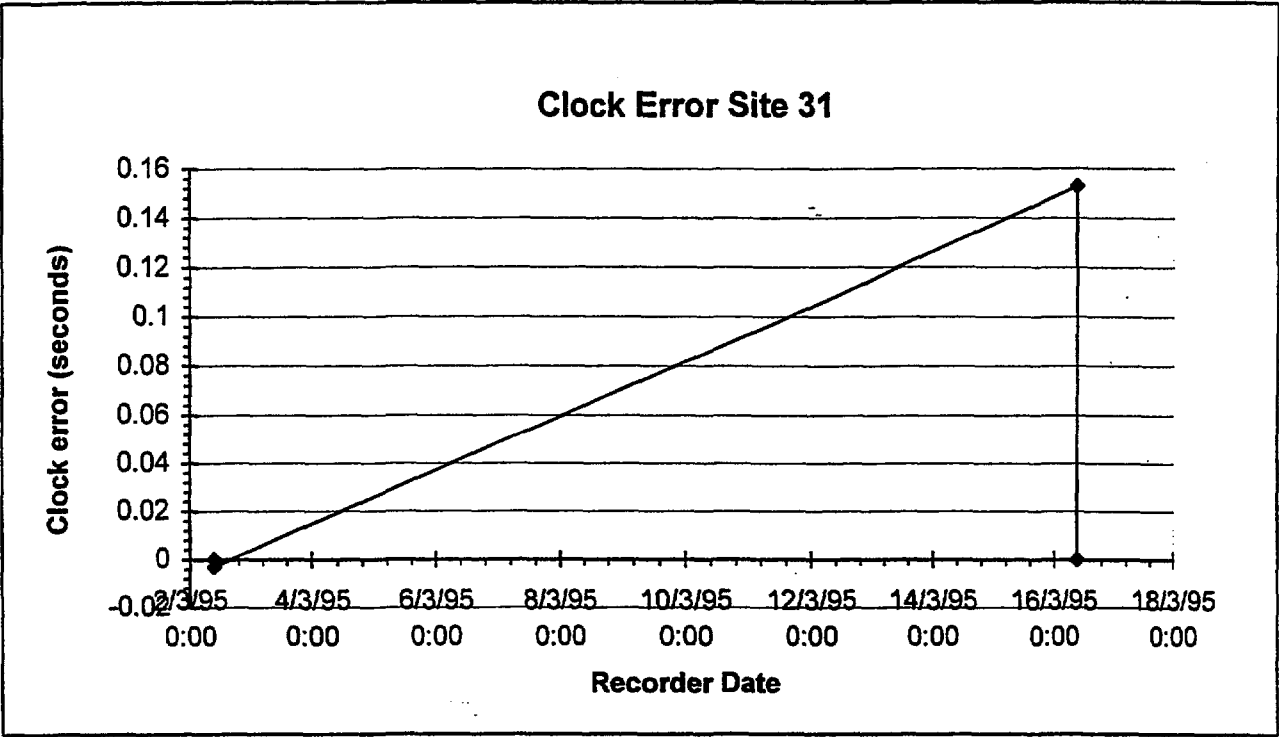
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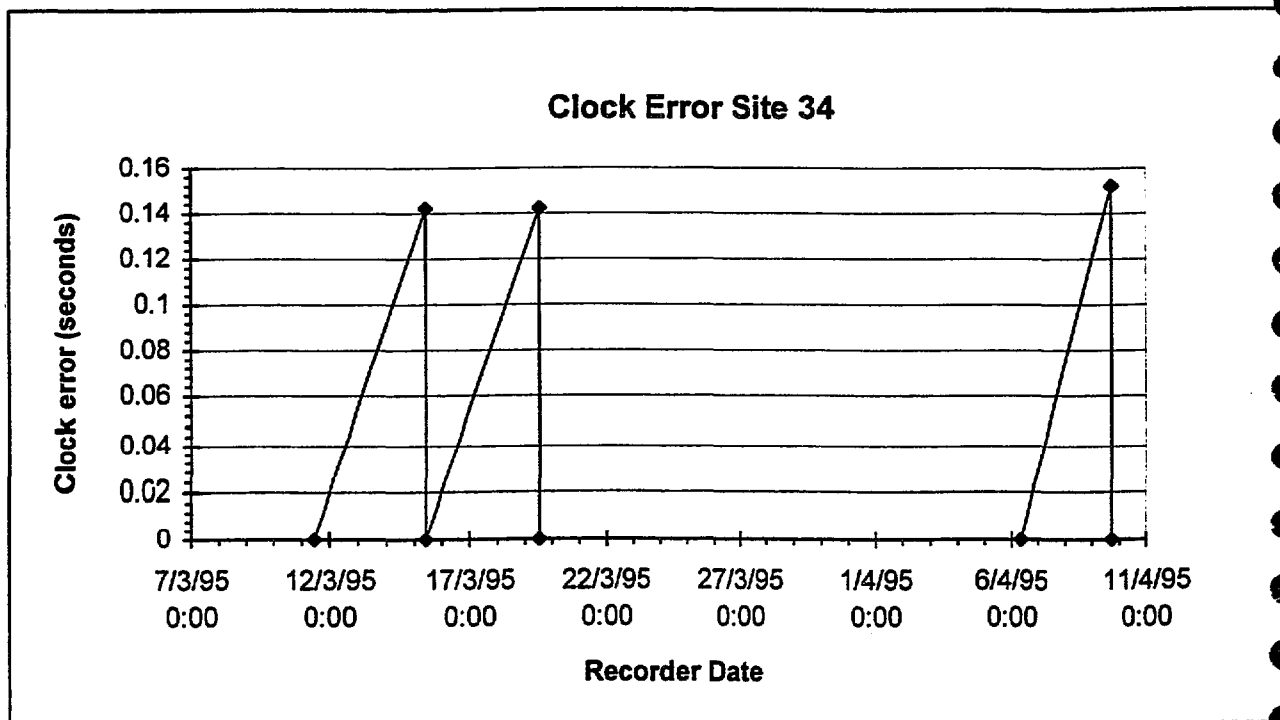
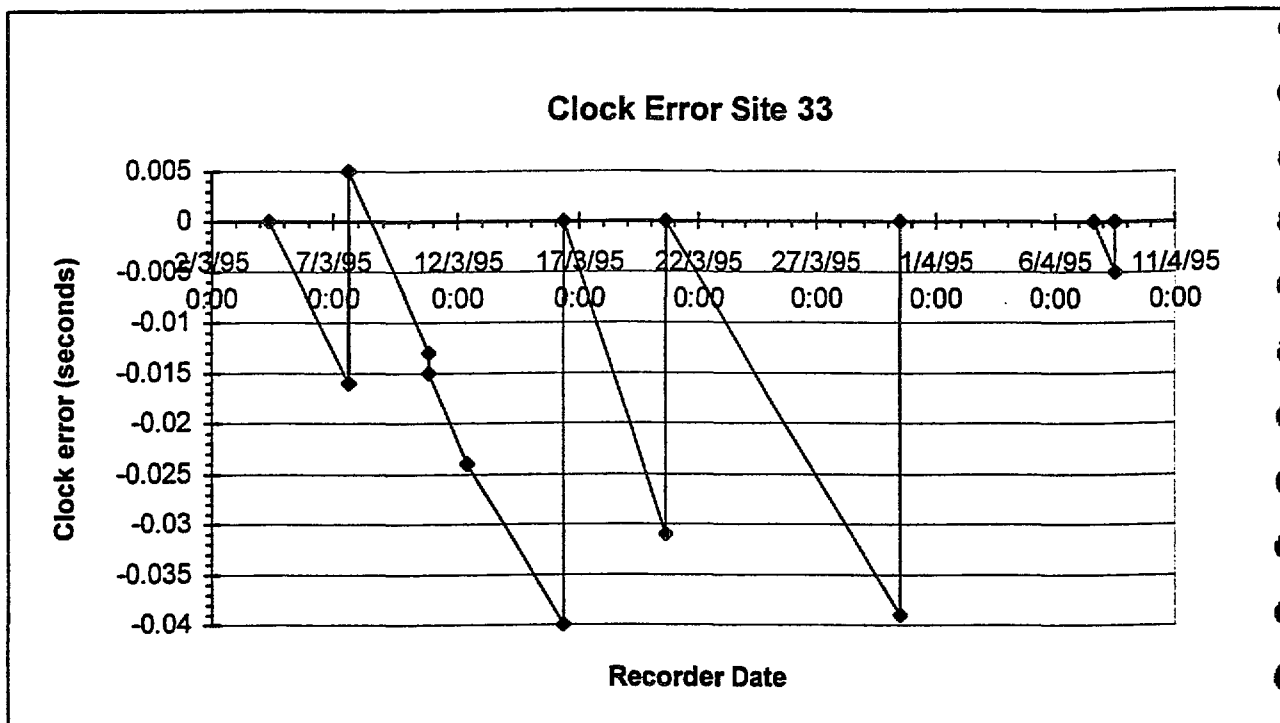
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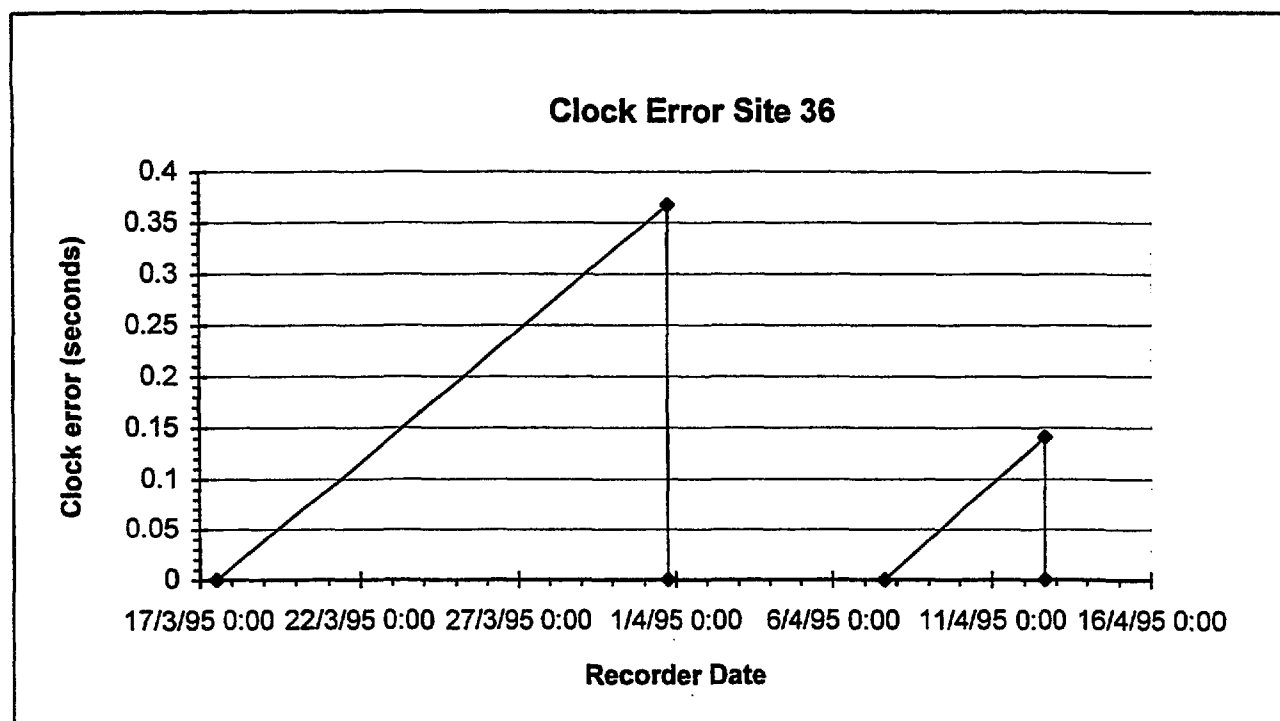
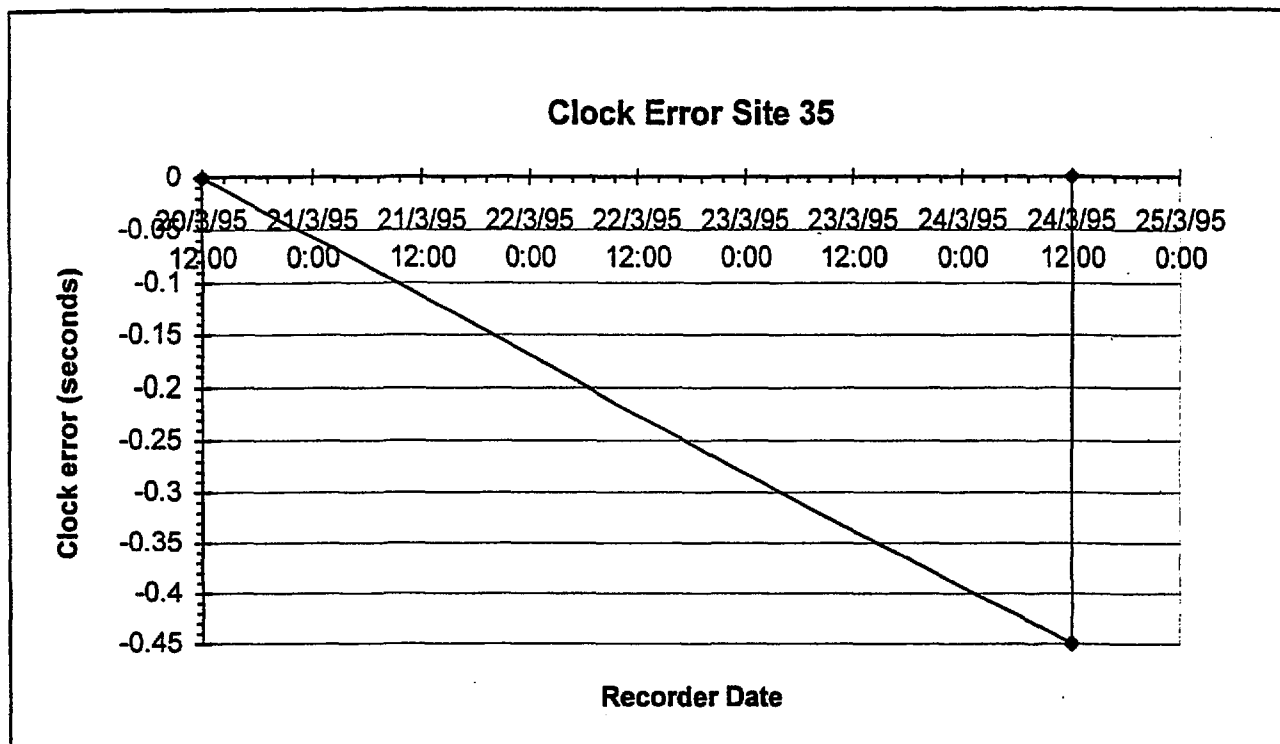
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