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DEPARTMENT OF ENVIRONMENTAL PROTECTION
Colleen M. Castille, *Secretary*

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REPORT OF INVESTIGATIONS NO. 103

HIGH RESOLUTION SEA-LEVEL HISTORY FOR THE GULF OF MEXICO SINCE THE LAST GLACIAL MAXIMUM

by

James H. Balsillie and Joseph F. Donoghue

FLORIDA GEOLOGICAL SURVEY
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PREFACE

In recent decades, much media attention has been directed at sea-level change and the possible future implications. Clearly any modest increase in sea-level would have a devastating impact on human coastal development throughout the world, especially here in Florida where our state is low in elevation and our population/infrastructure is very near the coast. There is a great deal of disagreement on the causes of sea-level change, and on the direction and magnitude of potential change that could be expected in the coming century. The most important clue we have in predicting the various Earth systems responses in the future, is to understand similar events that have occurred on Earth in the past.

There have been numerous studies conducted on the sea-level history of the Gulf of Mexico. These have been individual studies for specific sites using relatively small data sets. There has not, however, been a comprehensive analysis to compile and assess all available data to produce a regional sea-level history for the entire region. This report provides such a compilation and a quantitative analysis. It will be a valuable reference for coastal geoscientists and engineers as they try to better understand the dynamics of our coastal zone and predict system response to future events.

Walt Schmidt, Ph.D, P.G.
State Geologist and Chief
Florida Geological Survey

ACKNOWLEDGEMENTS

We thank Mark Siddall (Physics Institute, Climate and Environmental Physics, University of Bern, Bern, Switzerland) for the Red Sea $\delta^{18}O$ data set (calibrated to absolute ^{14}C years BP). We thank Paula J. Reimer (University of Washington Quaternary Isotope Laboratory, Seattle, WA) for her advice as to the proper application of the transformation program CALIB Rev 4.4.2. The review suggestions of Alan Niedoroda (URS Corp., Tallahassee, FL) for detailed plots and analyses of the younger data sets are acknowledged with thanks. L. James Ladner (Florida Geological Survey, Tallahassee, FL) brought to our attention the work of Cullen *et al*. (2000).

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ABSTRACT

Comprehensive, high-resolution, composite sea-level curves for the U.S. Gulf of Mexico since the last glacial maximum have been developed based on all available radiocarbon and calibrated absolute age-data. They are based on sea-level elevation indicators that, on the average, were measured once every 60 years for the past 20,000 years. The data sets consist primarily of geological sea-level indicators (some are archaeological). Published sea-level histories of the Gulf of Mexico exhibit significant variability. While there is error associated with the ^{14}C age dating methodology, the bulk of error is undoubtedly associated with the indicator material chosen to represent sea-level elevation. It is the latter that must be judicially treated. Such error has, perhaps, been inflated to such an argumentative and defeatist extent among researchers that comprehensive compilation and analysis of sea-level data for the Gulf, until now, has been avoided.

The objective of this investigation was to analyze all of the available sea-level data for the northern Gulf of Mexico, and to assess associated error and select data using three data editing procedures (one geological, the other two statistical) in order to identify a sea-level curve attaining an accuracy of least equivocal status. (1) We selected data for the Gulf of Mexico exhibiting tectonic and/or crustal stability, which yielded 353 radiocarbon-dated sea-level indicator data points. (2) We addressed the problem of identifying "spurious" sea-level data outliers that can be justifiably excused from inclusion in analytical procedures. This is not, in fact, a problem isolated to Gulf of Mexico data, but is normally the case for most data sets as can be easily verified by inspecting the comprehensive world-wide national and regional sea-level compilation of Pirazzoli (1991). Utilizing the eustatic data of Siddall *et al*, (2003), a statistically-based method has been proposed that might be considered by other researchers as a useful tool for post-initial editing of sea-level data. We found that only a few spurious data points can significantly affect analytical outcomes (only 12 spurious outliers were identified, or but 3.4% of the Gulf of Mexico sea-level indicators). (3) Once spurious "error" was eliminated, a sufficient amount of data remained (341 dated sea-level indicators) for which there was some considerable associated variability. We treated these remaining assembled data using a seven-point floating averaging method. By smoothing some of the noise, the moving average method mitigated the degree of probable associated variability, while allowing longer-term probable trends to remain; on the average seven dated points encompassed a period of 400 years with each floating point average representing a 60-year period.

In addition, we investigated the controversial subject of sea-level history younger than about 6,000 years (mid- to late-Holocene), and identified two "younger data sets" based on sampling location bias. One younger data set can be defined by sea-level indicators collected seaward of the present shoreline (younger data set A), the other by sea-level indicators collected landward of the present shoreline (younger data set B). Location relative to current sea level was assessed based on physical location in conjunction with elevation of sampling. By definition, sea-level indicators sampled seaward of current sea-level do not define high-stands. In addition, a detailed treatment of littoral processes associated with physiographic features (beach ridges, cheniers, and storm ridges) has been presented, indicating favor in the case of younger data set B. Both younger data sets are presented for scientific scrutiny.

As a consequence, the comprehensive compilation of northern Gulf of Mexico sea-level analytical results has significance beyond the local region. Gulf of Mexico data compare favorably with a recent late Quaternary sea-level data set from the Red Sea (Siddall *et al.*, 2003), a high-resolution index of eustatic sea-level. Given its geologic stability throughout the late Quaternary (in terms of data selected) and its relatively low-energy environments, the

northern Gulf of Mexico might be expected to have experienced near-eustatic sea-level conditions, and therefore offers a detailed record of global sea-level. In particular, the persistent evidence of mid- to late-Holocene high-stands in the Gulf of Mexico may be among the best global verifications of such events.

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INTRODUCTION

In a recent study of an archaeological site located near Florida’s northeastern Gulf of Mexico, Big Bend coast (Ryan-Harley Site 8JE-1004; Balsillie *et al*., in press, in review), it became necessary to make an accurate determination as to how far the approximately 10,700 ^{14}C year BP (Younger Dryas) site was from the Gulf of Mexico shoreline at the time of occupation. Upon reviewing the available literature on regional historic sea-level curves, it was found that the range of estimates for sea-level at the time of site occupation could be from 10 to 70 m below present mean sea-level (MSL). Given the regional gradient, these values yielded an unsatisfactory range of distances. Hence, the problem provided the impetus to find a numerical consensus as to the most probable sea-level elevation for a given date for the northeastern Gulf of Mexico.

Earliest reported sea-level measurements were begun in 1682 at Amsterdam (van Veen, 1954), in 1732 at Venice (Zendrini, 1802; Pirazzoli, 1974), and in 1774 at Stockholm (Ekman, 1988). The earliest known examples of Holocene sea-level histories were published by Granlund (1932) and Liden (1938) in Great Britain using pollen analyses and archaeological data.

Early in the 20th century, one popular explanation for beach erosion along the U. S. northeastern Atlantic coast was sea-level rise, much in the same manner as it has received renewed attention in recent years. For example, the State of New Jersey which, because of coastal development pressure accruing during the first two decades of the century, developed a strong interest in finding solutions to coastal erosion problems. Saville (1942) recounts “… the first really large scale attempt to study the underlying factors concerning the causes of coastal erosion, and means for controlling it*…”* was undertaken by the State of New Jersey between 1922 and 1930. By 1920, such beach resort communities as Atlantic City, Long Branch, Beach Haven, Asbury Park, Sea Isle City, Wildwood, and others had been developed as a consequence of their nearness to the urban centers of New York and Philadelphia. A shift in America from a rural agrarian to a metropolitan industrial population allowed more leisure time while rail lines facilitated transportation for ever-increasing numbers of people seeking beach recreation (Cunningham, 1958; State of New Jersey, 1922; Anonymous, 1960). After about 1910, affordable automobiles further facilitated the ease of transportation and Cunningham (1958) commented “*...* the automobile democratized Barnegat Peninsula.” It can be observed that it was not the forces of nature acting on the beach and coast which had undergone a dramatic change. Rather, due to increased occupation of the coastal zone, mankind's perception of nature’s forces had changed. The beaches and coasts were now more than merely a natural accumulation of sand. They were viewed as a source of recreation and profit, and coastal New Jersey properties became a valuable asset. From 1922 to 1932 New Jersey's coastal property increased in value from $2.3 million to $4.2 million per mile of beach, an increase of a factor of 1.83 (Cunningham, 1958).

Coastal residents along the 130-mile New Jersey shore quickly became more than casually concerned with beach and coast erosion due to storm and hurricane impact and other general shifts in shoreline position. The popular and technical literature of the time brought even greater attention to the problem. The increasing numbers of coastal residents began to seek solutions to coastal erosion. Highlighting the paucity of basic knowledge of coastal processes, Sharp (1927) stated:

> Conditions vary so widely from place to place that rule-of-thumb methods are sure to give a large percentage of failures, and a structure successful at one place may be a dismal failure at another. On the other hand, the engineer who wishes to attack his problem scientifically finds that science has done very little to help him. He is almost without trustworthy facts, and must work up his data from hasty studies of his own.

Even so, individuals began to seek explanations for erosion problems which freed them from having to answer for their unwise coastal development decisions, allowing them to be the "innocent victims" of the "caprices" of nature. One popular explanation of erosion at the time was sea-level rise by way of land subsidence. The topic became one of considerable controversy (*e.g.,* Johnson and Smith, 1913), much as it is today. In 1922, the New Jersey Board of Commerce and Navigation (State of New Jersey, 1922) opined that evidence was insufficient to suggest that sea-level was "… a definite and permanent transition from one state to another, traceable to some clearly defined cause."

The Uniformitarian Principle proposed by James Hutton in 1785 states that *the present is the key to the past*. The corollary that "the past is the key to the present and to the future" must also hold true. And so it was, that scientists began seeking evidence about past sea-levels in order to gain insight as to how sea-level could behave in the future.

Concerted study of late Quaternary sea-level behavior did not come of age until the advent of the radiocarbon dating technique in the 1950's. By the early 1960's, it became clear that late Quaternary global and/or Gulf of Mexico sea-level histories could be variously classified according to four general modes of behavior. (1) Fairbridge (1961) assembled an oscillating eustatic curve, also described in terms of crescendo events (Fairbridge, 1989), as pulses (Tanner, 1992b, 1993), and as cycles (Finkl, 1995; Fairbridge, 1995, Sanders and Fairbridge, 1995). This oscillating curve rose rapidly from the early Holocene to about 6,000 years before present (BP), after which it has oscillated about the current mean sea-level (MSL) position. (2) Shepard (1963, 1964) published a smooth curve that rose at a continuously diminishing rate arriving at the present MSL in very recent times. (3) A third geometry (*e.g.*, Fisk, 1956; Godwin *et al.* 1958; McFarlan, 1961) is defined by a smooth, continuously rising curve from the early Holocene to about 5,500 years ago, followed by sea-level stability at or near the current MSL position. (4) A "stair-step" pattern has been proffered (Curray, 1960; Frazier, 1974; Penland *et al.*, 1991, *etc.*) that attained approximately current sea-level stability in more recent times. Other early investigators (Gould and McFarlan, 1959; McIntire and Morgan, 1964; Redfield and Rubin, 1962) were not so certain about the time of attainment of current sea-level, suggesting it occurred somewhere between 2,000 and 5,000 years BP. Coleman and Smith (1964) were more definitive suggesting it occurred at about 3,650 years BP; Rodriguez (1999) suggested occurred about 3,000 years BP. Blum *et al.* (2002) provde a "traditional" overview of Holocene sea level history. More recently, Gehrels (1999, p. 350) has stated that the "… debate between the "wigglers" and the "smoothers" persists, but the nature of the argument has changed. It is now clear that oscillations of postglacial sea-level on time scales of 10^1 to 10^2 yr have occurred …".

Above earlier considerations and other differences led the International Union of Geological Sciences (IUGS) to form in 1974, the IUGS International Geological Correlation Programme (IGCP), Project 61. Entitled Sea-level Changes During the Last Hemicycle (c. 15,000 Years), Project 61 had as its goal of defining the eustatic (global) sea-level curve. Eustatic, in this sense, refers to a sea-level curve that represents global sea-level conditions (*e.g.*, Bloom, 1971, p. 356). In 1976, it was concluded that late Holocene sea-level histories can vary significantly from region to region, and that "…the determination of a single sea-level curve of applicability was an illusory task*…"* (Pirazzoli, 1991, p. 4). In 1977, A. L. Bloom who headed Project 61 published the *Atlas of Sea-Level Curves* (Bloom, 1977). In 1983, IGCP Project 200 entitled Sea-Level Correlation and Applications (P. Pirazzoli, project manager) was initiated to "… determine local sea-level histories as precisely as possible …" (Pirazzoli, 1991, p. 5). A successor project was begun in 1988, IGCP Project 274 (Sea-level changes during the Late Quaternary, headed by Orson Van de Plassche. Both of the latter projects served to further confirm the thesis that sea-level history varies significantly from region to region, depending on the geologic character and history of the coast. A summary of Project 274 (Pirazzoli, 1991) entitled *World Atlas of Holocene Sea-Level Changes* documented the wide range of regional sea-level histories from around the globe. This comprehensive work contains 905 local Holocene sea-level curves for 77 global regions forthcoming from over 750 referenced contributions. Pirazzoli (1996) has subsequently published a new edition entitled *Sea-Level Changes: The Last 20000 Years.*

Published data for the northern Gulf of Mexico represents a subset of the above data sets, plus results from studies carried out since the earlier compilations. In analyzing the published data, it was assumed that investigators involved in radiocarbon dating work have responsibly reported their findings. Beyond that, any numerical treatment of results should be straightforward.

For the present project, late Pleistocene and Holocene sea-level data for the northern and eastern Gulf of Mexico coast – both published and unpublished - were collected and examined. The purpose of this investigation was twofold: 1) to define the regional sea-level history of the northern Gulf of Mexico, using all of the available chronological data on sea-level history; and 2) to provide evidence that, for stable coastal regions of the Gulf of Mexico coastline, sea-level history approximates global (*i.e.,* eustatic) sea-level.

RADIOCARBON DATING AND RELATIONSHIPS BETWEEN RADIOCARBON, CALENDAR, AND ABSOLUTE DATES

All pertinent Gulf of Mexico sea-level data in the present data sets are based on radiocarbon dating of shoreline indicators. A variety of analytical problems can affect radiocarbon age determinations. Radiocarbon ages are given in years BP (referenced to 1950 A.D.) with a plus-and-minus error. This error, by definition, is the standard deviation. One of the assumptions made in radiocarbon dating is that no change in ^{14}C content other that radioactive decay occurs in a sample after the death of the organism. This assumption is often unrealistic as documented by Mook and van de Plassche (1986). An additional source of radiocarbon dating error concerns the ^{14}C half life. By long-term convention the ^{14}C half-life used in age determinations is 5,568 years; this value is actually in error by three percent and should be 5,730 years. Whether or not older data sets have been corrected for this discrepancy may not be apparent. Assuming that, in published results, such problems as

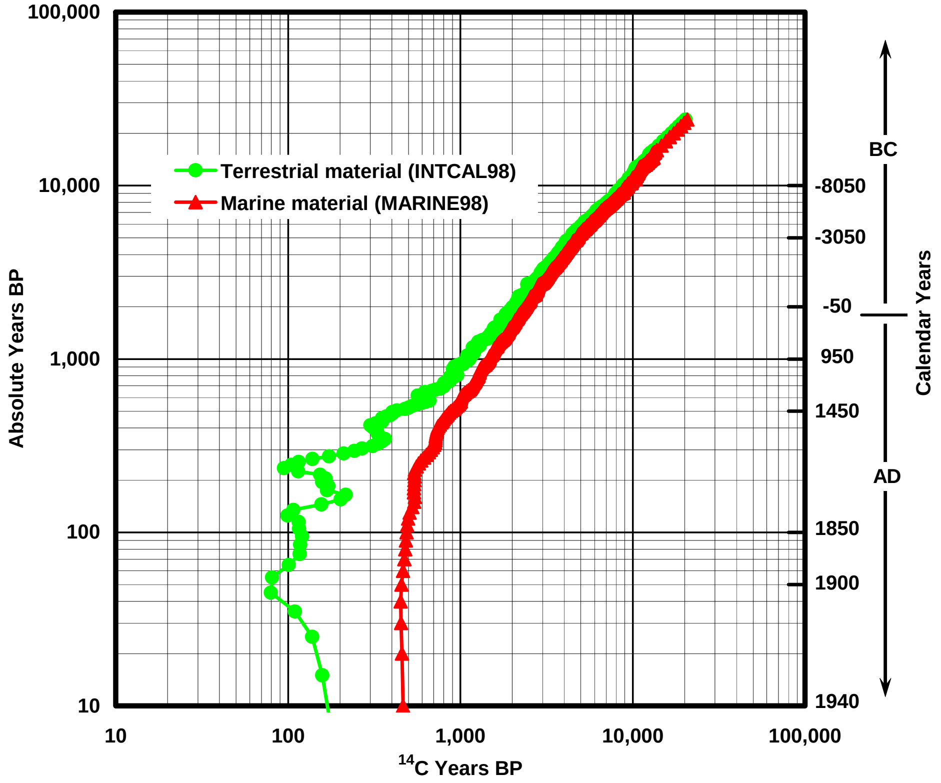

Figure 1. Relationship between ^{14}C years BP (present = 1950 AD), calendar years, and absolute (sidereal) years BP using the IntCal98 data set for terrestrial material (Stuiver *et al*., 1998a), and the Marine98 data set for marine material (Stuiver *et al*., 1998b).

those above have been corrected to the maximum extent possible, ^{14}C dates still do not represent true calendar years. Radiocarbon years would be equivalent to calendar years only if the ^{14}C concentration in the atmosphere were constant over time. This has been shown not to be the case. Atmospheric ^{14}C concentration has fluctuated due to variation in cosmic radiation intensity, fossil fuel burning, and nuclear testing (Faure, 1986; Suess, 1986). In order to understand sea-level change in terms of absolute or sidereal time, radiocarbon dates for the current data set can be converted using a calibration scheme. Radiocarbon calibration methods are based on comparing radiocarbon dates with actual ages for samples whose absolute age has been determined independently, such as via tree rings or lake varves.

One of the standard calibration schemes incorporating dendrochronologically dated wood samples is the CALIB program developed by the Quaternary Isotope Laboratory of the University of Washington (Stuiver and Kra, 1986; Stuiver and Reimer, 1993; Stuiver *et al.* 1998a, 1998b; McCormac *et al.* 2002). Several calibration data sets are available. For terrestrial materials, the **IntCal98** decadal data set (1998 atmospheric delta ^{14}C; Stuiver *et al.*, 1998a) can be applied to data from the Gulf of Mexico region. For marine material, the **Marine98** data set (1998 marine delta ^{14}C; Stuiver *et al.*, 1998b) can be used where regional offsets can be applied (*e.g.*, Stuiver and Braziunas, 1993; Stuiver *et al.*, 1998b). As far as can be ascertained, this application along with any regional offsets provides the best calibration available. Using CALIB (Rev 4.4.2), the current data set have been converted to absolute or sidereal years. Decadal data sets **IntCal98** and **Marine98** have been plotted in Figure 1 to illustrate the relationship between calendar years and absolute years versus ^{14}C age.

A NEW GLOBAL SEA-LEVEL RECORD

We begin our analysis by considering a recent effort in determining the "eustatic" sea-level record for the late Quaternary. Siddall *et al.* (2003) presented an original method for determining global sea-level changes for the last glacial cycle, using δ^{18}O analyses of foraminifera from Red Sea sediment core KL11. The new method has been met with considerable interest as a new approach to defining eustatic sea-level change (*e.g.*, Sirocko, 2003; Rohling *et al.*, 2003).

Geomorphology and hydrology of the Red Sea Basin combined with effects occurring at low latitudes renders sensitive Red Sea δ^{18}O results. Low latitudes equate to high evaporation rates leading to higher salinities for ocean water bodies and, hence, enriched ^{18}O levels. For the Red Sea the only significant link with oceanic waters is the southern entrance (Bab el Mandab) which is but 18 km wide. Furthermore, there is at the entrance a sill restricting water flow. At present sea-level, the top of the sill lies at about -137 m MSL. At the last glacial maximum it lay at a depth of only about -15 m MSL. At lower sea-level stands, evaporation and increased salinity resulted in stronger δ^{18}O signatures. In short, the Red Sea KL11 core results provided a greatly amplified δ^{18}O record for progressively lower sea-level stands. All that remained was to compile a simple numerical model for attenuating δ^{18}O results for higher sea-level stands, and to tie the results to five ^{14}C age markers.

The "… broader significance …" (Sirocko, 2003) of this work lies in how it might relate to the δ^{18}O record from polar ice cores. Ice cores *Byrd* and *Vostok* from Antarctica and *GISP2* from Greenland have been correlated. The KL11 record shows "…for the first time that the temperature variations documented for the Antarctic were probably paralleled by changes in sea-level …" and that the "… beauty of Siddall and colleagues' approach compared with … other methods is that it can be applied to very high-resolution records as well as very long records" (Sirocko, 2003).

In addition to Red Sea foraminifera δ^{18}O data, Siddall *et al.* (2003) also included ^{14}C coral data results from Barbados (Fairbanks, 1989, 1990; Bard *et al,* 1990), Tahiti (Bard *et al.*, 1996), and New Guinea (Edwards *et al.*, 1993) to augment their global (eustatic) sea-level curve status (Table 1). Data sources are listed in Appendix I. These global sea-level data are plotted in Figure 2. Absolute and ^{14}C dates for these data have been calculated using CALIB Rev. 4.4.2, described earlier. We present these global sea-level curve data because they are important as a reference that can be used to identify spurious outliers in regional data such as our Gulf of Mexico data sets. Representative transcendental equations were fitted to the global sea-level data (7-point floating average curve of Figure 2). Equations and plotted results are shown in Figure 3.

GULF OF MEXICO SEA-LEVEL CURVE

Twenty-three data sources or subsets (Table 1) were examined, resulting in 353 dated sea-level stand indicators for assessment of sea-level history of the Gulf of Mexico. The data cover the past approximately 20,000 years of geologic time. The data are plotted in Figures 4 (^{14}C dates) and 5 (absolute ages). Not all data subsets are plotted in the figures (see figures for clarification). There are data younger than about 6,000 ^{14}C years BP that, if plotted at small scale, would render the figures illegible due to the high concentration of data points. Therefore, the data are divided into two age ranges: 1) ages between 18,000 ^{14}C years BP and 6,000 ^{14}C years BP, and 2) ages younger than 6,000 ^{14}C years BP.

Table 1. Sea-level – ^{14}C data sets used in this study (see Appendices for additional details).

	Investigators	Location	n
	Data Pertinent to the Gulf of Mexico		
1	Curray (1960)	Texas Gulf Coast	13
2	Shepard (1960)	Texas-Louisiana Gulf Coast	11
3	McFarlan (1961)	Louisiana Gulf Coast	12
4	Fairbridge (1961, 1974)	Eustatic	51
5	Spackman *et al.* (1966)	SW Florida Gulf Coast	2
6	Behrens (1966)	Mexican Gulf Coast	3
7	Scholl and Stuvler (1967)	SW Florida Gulf Coast	12
8	Schnable and Goodell (1968)	NE Florida Gulf Coast	11
9	Shier (1969)	SW Florida Gulf Coast	3
10	Smith (1969)	SW Florida Gulf Coast	1
11	Nelson and Bray (1970)	Texas Gulf Coast	11
12	Frazier (1974)	Texas-Louisiana Gulf Coast	27
13	Stapor and Tanner (1977); Tanner *et al.* (1989); Tanner (1991a, 1991b, 1992a, 1993)[1]	St. Vincent Island, Florida	11
14	Davies (1980)	Florida	15
15	Kuehn (1980)	SW Florida Gulf Coast	8
16	Robbin (1984)	Florida Keys	25
17	Fairbanks (1989, 1990)	Barbados	56
18	Schroeder *et al.* (1995)	NE Gulf of Mexico	10
19	Faught and Donoghue (1997)	NE Gulf of Mexico	11
20	McBride (1997)		8
21	Morton *et al.* (2000)	Texas Gulf Coast	25
22	Blum *et al*. (2001)	Texas Gulf Coast	8
23	Stapor and Stone (2004); Stapor *et al.* (1991); Walker *et al.* (1995)[1]	Louisiana and SW Florida Gulf Coast	19
		Total =	353
	Other Data Considered		
24	Edwards *et al.* (1993)	New Guinea	13
25	Bard *et al*. (1996)	Tahiti	34
26	Siddall *et al.* (2003)	Red Sea	87
		Total =	134

n = number of dated sea level stands

[1] Data were extracted from published sea level curves whose time-lines were based on age control points.

Identifying Spurious Data

It is a singular mandate of the responsible scientist that he or she consider and assess all of the available evidence toward solving a particular problem. At the outset it is highly important to note that we scrupulously deliberated (from the obvious perspective) as to whether or not available Gulf of Mexico data represented, as nearly as possibly could be determined, stable vertical sea-level indicators. For instance, we rejected the majority of McFarlan's (1961) Mississippi delta data where subsidence influences were obviously a problem, selecting only his younger beach and chenier data (< 3,500 absolute years BP) which would more nearly represent sea-level stands, and where subsidence influences would be minimal. The studies of Gould and McFarlan (1959) and Coleman and Smith (1964) examined post-glacial sea-level histories in the Mississippi delta region. While their data addressed regional

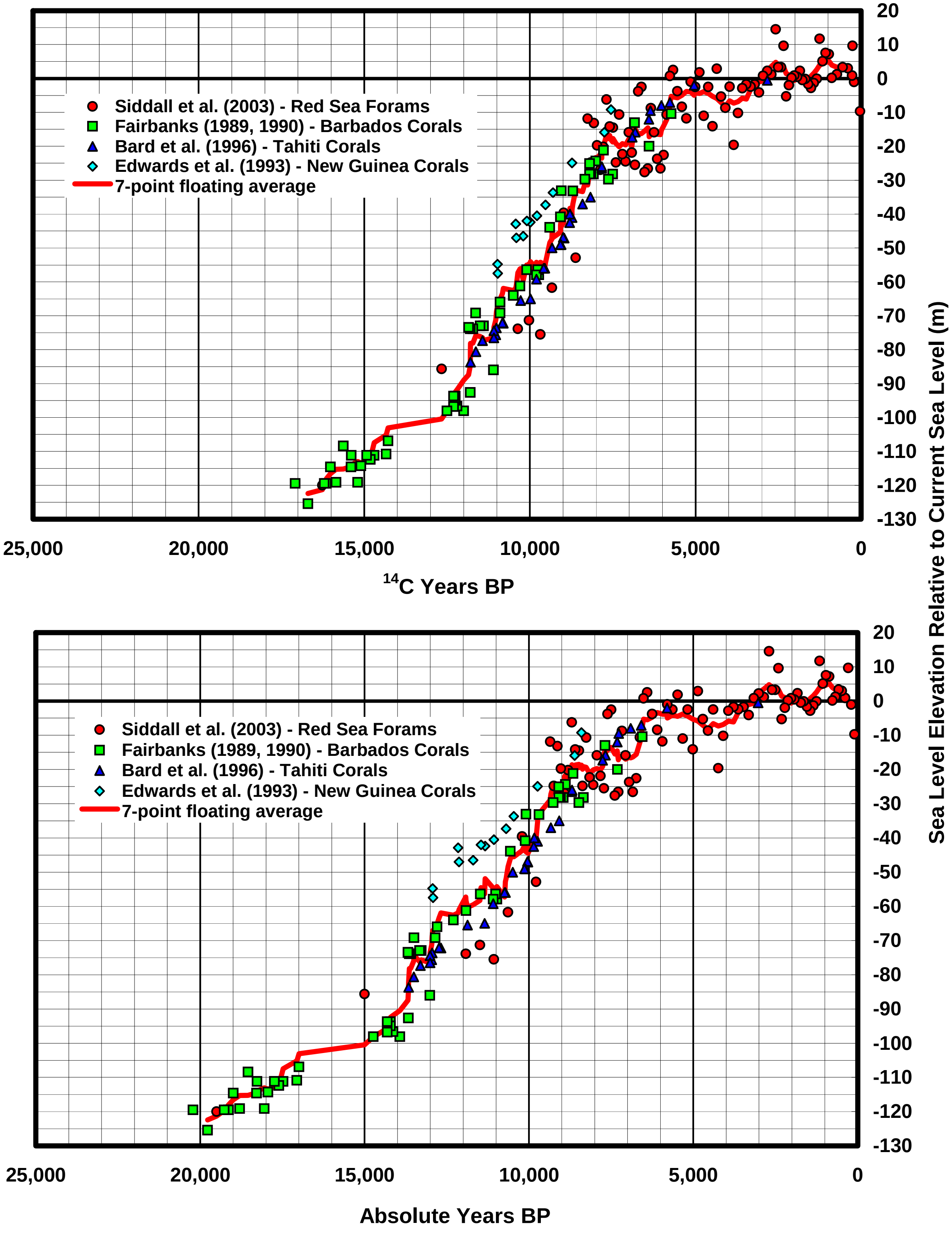

Figure 2. Global ("eustatic") sea-level data, including Red Sea data of Siddall *et al.* (2003), augmented with coral reef data of Fairbanks (1989, 1990) from Barbados, Bard *et al.* (1996) from Tahiti, and Edwards *et al.* (1993) from New Guinea. A 7-point floating average has been fitted to the data sets.

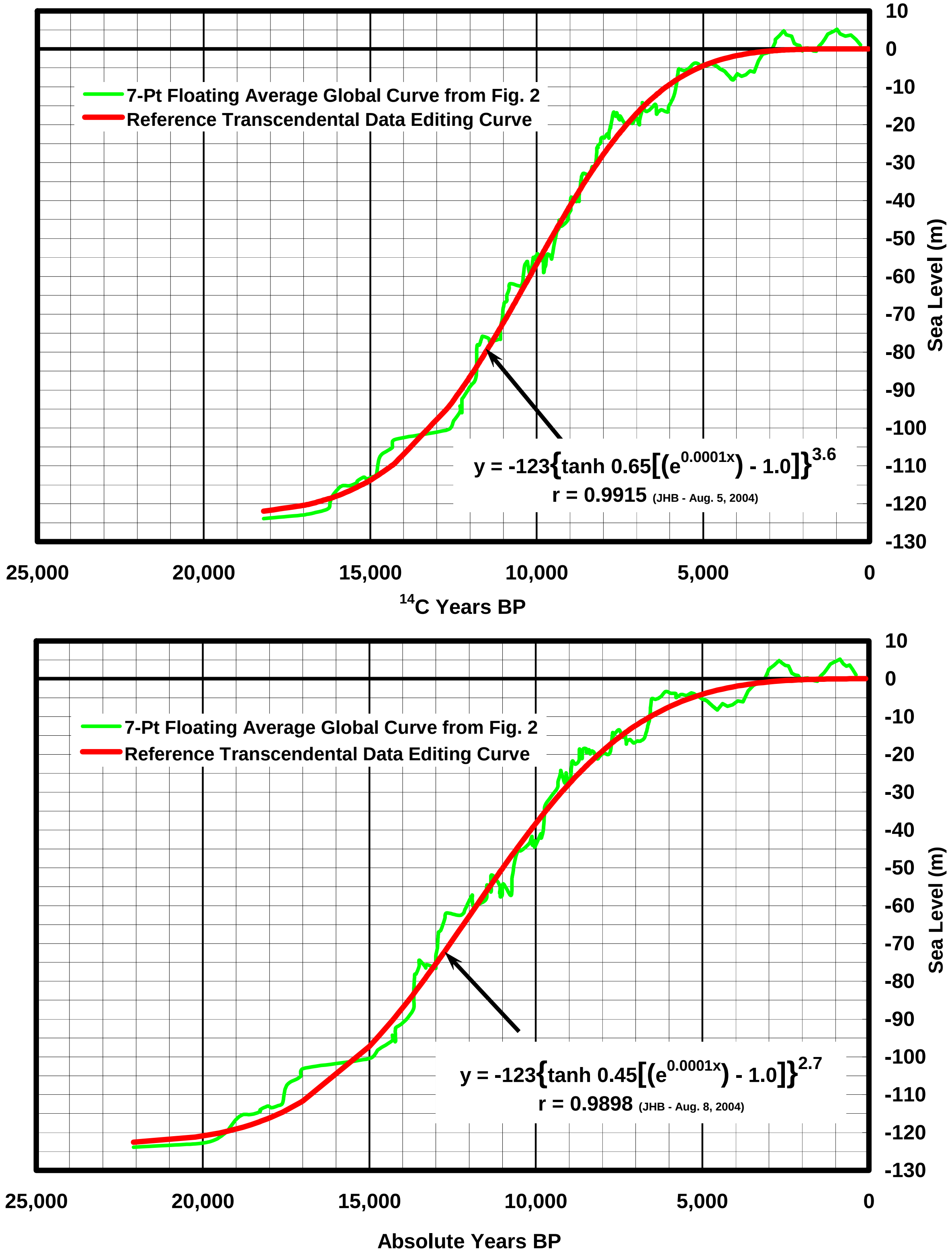

Figure 3. Representative transcendental equations and curves fitted to 7-point floating average global sea level curves of Figure 2. Transcendental curves are meant for data editing purposes only.

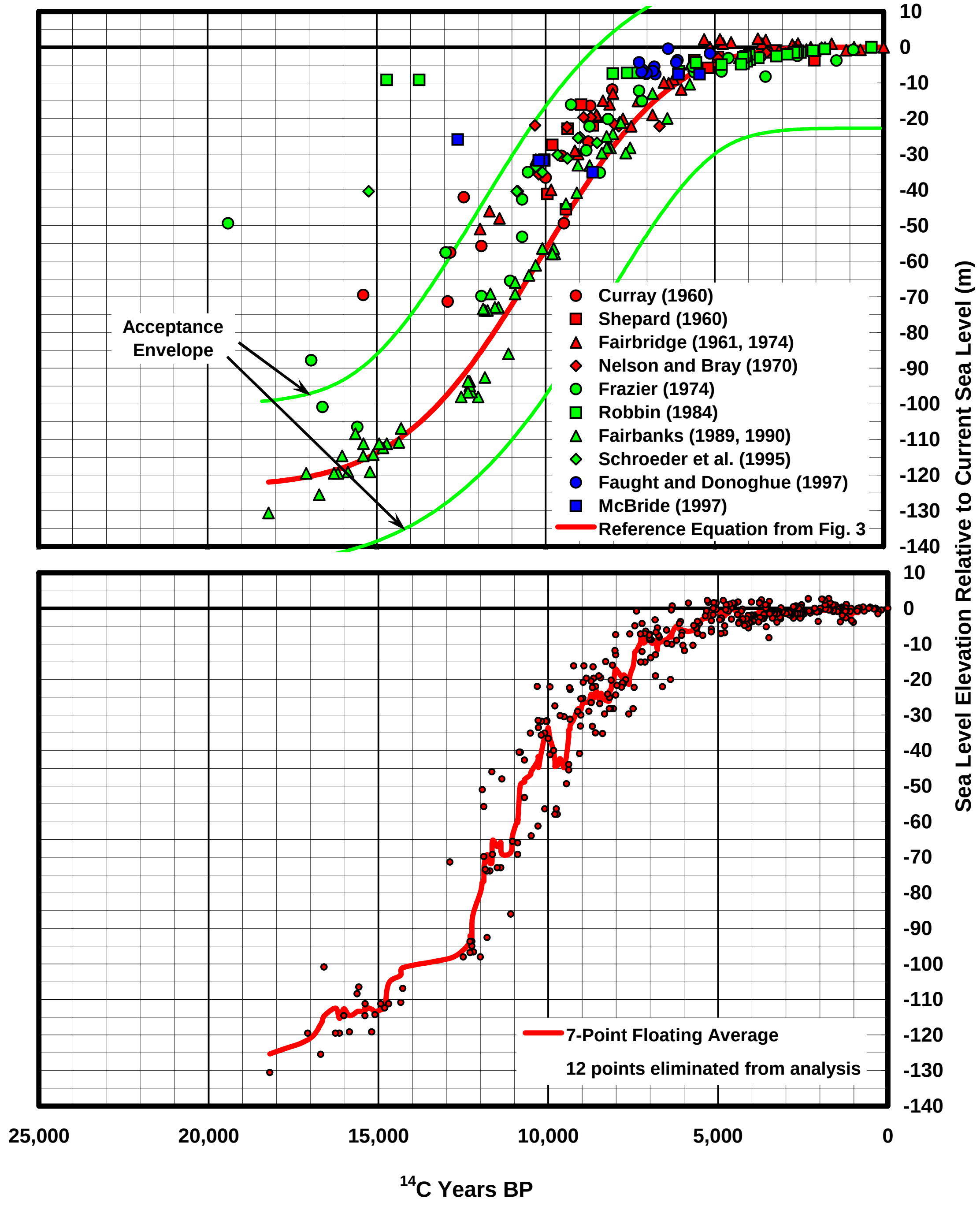

Figure 4. Gulf of Mexico ^{14}C age sea-level data. Upper panel illustrates the Gulf of Mexico data set, with the global (eustatic) reference curve from Fig. 3 superimposed. Also shown is an acceptance envelope statistically containing 96.43% of data (3.6% of data lie outside the envelope). Only some of the younger data (less than 6,000 ^{14}C years BP) are plotted in the upper panel in order to provide greater clarity, although all those data sets that are affected by the editing process do appear. Lower panel shows 7-point floating average curve fitted to all of the Gulf of Mexico data sets considered in this work; 12 points were rejected from analytical consideration (3.4% of the actual total data).

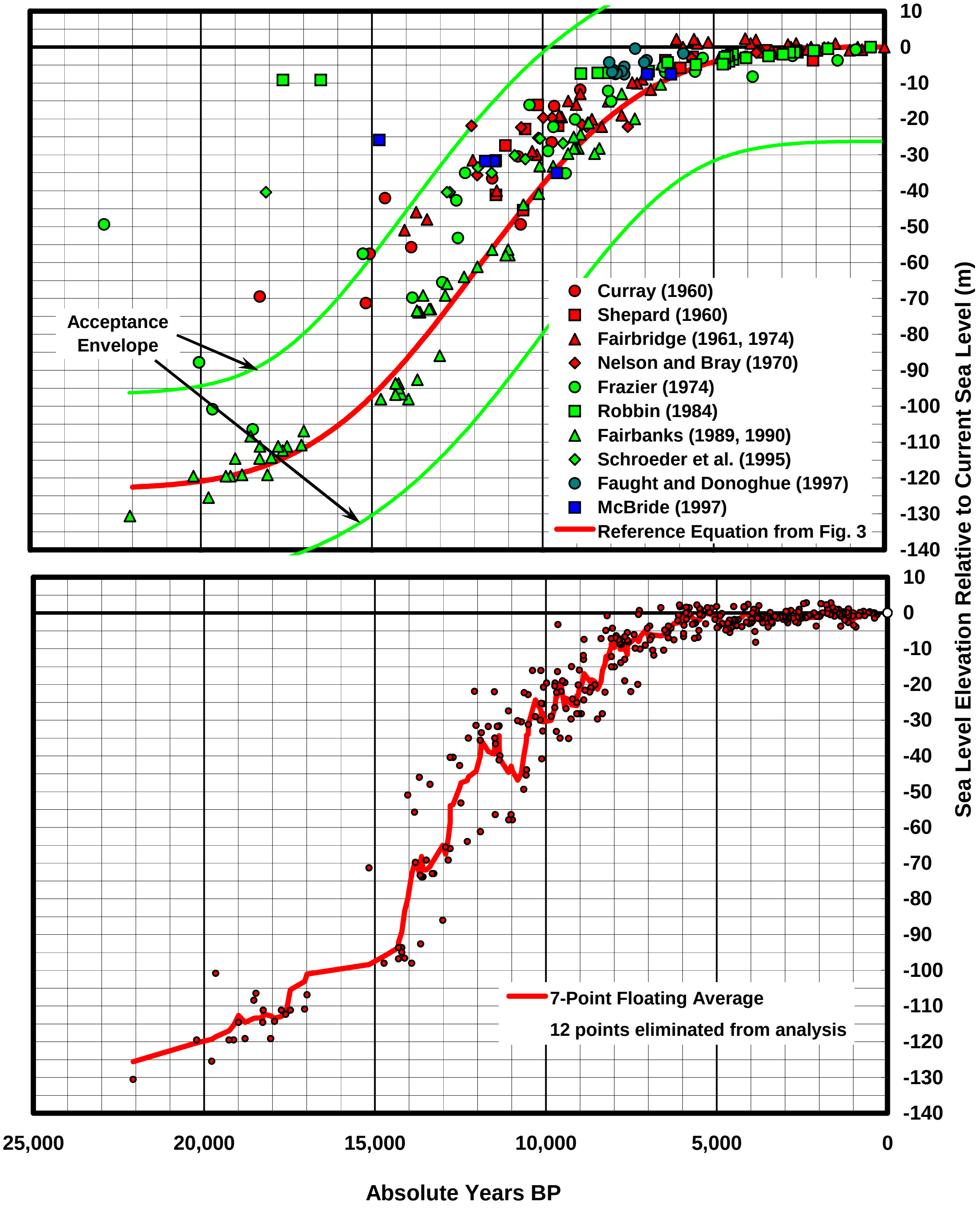

Figure 5. Gulf of Mexico absolute age sea-level data. Upper panel illustrates the Gulf of Mexico data set, with the global (eustatic) reference curve from Fig. 3 superimposed. Also shown is an acceptance envelope statistically containing 96.85% of data (3.2% of data lie outside the envelope). Only some of the younger data (less than 6,000 ^{14}C years BP) are plotted in the upper panel in order to provide greater clarity, although all those data sets that are affected by the editing process do appear. Lower panel shows 7-point floating average curve fitted to all Gulf of Mexico data sets considered in this work; 12 points were rejected from analytical consideration (3.4% of the actual total data).

subsidence, the lack of certainty in such calculations led us to exclude them from our data set. These data represents results early in the effort to identify sea-level stands, when technological advances are not what they are today. A very recent study, however, poses concerns. Tornqvist *et al.* (2004) have reported on sea-level indicators from the Mississippi delta taken at depth in cores *(i.e.,* may not represent sub-aerial sea-level evidence), and apply unclear subsidence corrections. Moreover, they have not considered other available sea-level history data sets in their investigations, and have then posited conclusions based on a limited amount of information for a limited area of the Gulf of Mexico. Following our data selection criteria, their data have not been included in our compiled data set.

Upper panels of Figures 4 and 5 demonstrate the degree of variability of Gulf of Mexico sea-level data. Analytical problems associated with ^{14}C sea-level determinations (*e.g.*, Pirazzoli, 1991) include those associated with tectonic activity and crustal stability, selection of features that actually represent sea-level stands, sample material contamination and reworking, and accurate determination of elevations relative to a professionally determined sea-level datum. It is not surprising, therefore, that such variability occurs. Gulf of Mexico data do not constitute a special case. All one has to do is inspect the regional data of Pirazzoli (1991, 1996) to see that such variability exists for the great bulk of regional data sets. Our approach was to apply the results of the new global (eustatic) sea-level curve (Figure 2) similar to that presented by Siddall *et al.* (2003) as a tool for assessing the quality of the Gulf of Mexico data. Two representative transcendental equations were developed for the Siddall *et al.* (2003; including Atlantic Ocean coral data of Fairbanks, 1989, 1990; and Pacific Ocean coral data of Edwards *et al.*, 1993; and Bard *et al.*, 1996) data - one for the ^{14}C data and one for absolute year BP data as shown in Figure 3. The resulting reference curves from these equations were superimposed on the Gulf of Mexico data.

From the preceding discussion it should be evident that while error is associated with dating methodologies, it is statistically manageable. Error associated with sea-level indicator material, however, is not known and this leads to the more egregious uncertainty about past sea-level behavior. One can, however, utilize certain innovative statistical applications to approximate internal variability of sea-level indicators. In this work the standard deviation of Gulf of Mexico sea-level elevation data (σ_{SLE}) was used as the assessment statistic. EXCEL computer applications were compiled to automatically identify outliers that can be justifiably eliminated from further analysis using statistical constraints. Programmed applications determine the centroid of the selected data distribution and σ_{SLE}, applying them to the representative transcendental global data editing curves of Figure 3. An essential characteristic of the analysis was that ordinate and absicca values were equivalently scaled and rendered dimensionless by dividing ^{14}C and absolute years by 100 years and dividing sea-level values by -1.0 m. There were several ways in which to statistically assess variability internal to sea-level indicator information. In this work, the normal (*i.e.*, perpendicular) distance from the reference editing curves resulted in precisely parallel curves defining the acceptance envelope which initially compute and encompass 68% of the data (*i.e.,* 1.0 σ_{SLE}), assuming the data conformed to a Gaussian Probability Density Distribution (GPDD). Similarly defined but refined acceptance envelopes were then investigated to finalize the acceptance envelope. This was accomplished by selecting values for two input variables: 1) the number of standard deviations, c, which was assessed as c σ_{SLE}, and 2) the time period for which the attendant internal sea-level variability was to be assessed. These input variables were then modified relative to each other until the actual number of outliers and the theoretical (*i.e.*, GPDD statistical) number of outliers, converged in magnitude. It should be understood that there are many possible outcomes depending on specified input variables. Two conditions, however, were applied in order to attain final results: 1) the use of common sense and inspection for cohesiveness of data, and 2) generally, the elimination of as few spurious points as possible. For the Gulf of Mexico data, resulting outcomes were as follows. For the ^{14}C age data (Figure 4), 2.1 σ_{SLE} resulted in the theoretical Gaussian statistical outcome of 13 justifiably eliminated spurious data points (3.6% of the data), and an actual count of 12 spurious data points (3.4% of the data) that can be justifiably eliminated from further analysis. For the absolute age data (Figure 5), 2.15 σ_{SLE} resulted in the theoretical Gaussian statistical outcome of justifiably eliminated spurious data points (3.2% of the data), and an actual count of 12 spurious data points (3.4% of the data) that can be justifiably eliminated from further analysis.

Table 2. Some average characteristics of the Gulf of Mexico sea-level data sets.

Age Type	Age Range (Years BP)	Sample Size n	Average Number of Years per Measurement	Average Deviation from 7-Point Average Fitted Line
OLDER DATA SET				
^{14}C	6,000-18,200	156	79	±6.58 m
Absolute	6,000-21,000	171	93	±6.66 m
^{14}C	6,000-12,000	129	46	±6.75 m
Absolute	6,000-12,000	120	48	±5.74 m
^{14}C	12,000-18,200	27	230	±5.76 m
Absolute	12,000-22,000	51	197	±8.81 m
YOUNGER DATA SET A				
^{14}C	< 6,000	77	71	±1.09 m
Absolute	< 6,000	69	82	±1.02 m
YOUNGER DATA SET B				
^{14}C	< 6,000	108	55	±1.30 m
Absolute	< 6,000	101	59	±1.14 m
ALL DATA				
^{14}C	< 18,200	341	53	±3.74 m
Absolute	< 22,000	341	65	±3.97 m

We emphasize that the identification of unacceptable sea-level data was critical to our analysis. We found that only a few spurious data pairs can significantly affect analytical outcomes. Only 12 points were identified based on the applied analyses, or 3.4% of the total number of data points considered for the Gulf of Mexico.

Older Data Set

Variability of the remaining data comprising the older data set is such that only the most straightforward of statistical smoothing applications is warranted. For the data at hand, an nth order floating point average application is appropriate. For any sequence of numerical data the larger the number of data points involved in a sequential floating point average, the smoother the resulting curve. The question arises, therefore, as to the number of data points to be included in each mean calculation. The present data set contains a significant amount of variability, as can be observed in Figures 4 and 5. Moving average windows of 5 or less were found to retain a significant amount of noise. It was found that a 7-point floating average removes much of the noise. At the same time, a 7-point window retains much useful information, because 7 points typically represent less than 400 years of sea-level history. Moreover, if one is concerned about such variation, they are free to apply smoothing procedures such as nth order polynomial applications. Results for the 7-point floating average application are illustrated in Figure 4 (lower panel) for ^{14}C data, and in Figure 5 (lower panel) for absolute age data. Some average characteristics of the Gulf of Mexico data set are listed in Table 2. Older data set Gulf of Mexico sea-level curve data are listed in Appendix II.

Younger Data Sets

Sea-level information younger than about 6,000 ^{14}C years BP poses more intriguing questions. The younger data can be divided into two subsets, based on sampling location. Samples collected offshore of the present shoreline, by definition, do not include evidence of high-stands. These samples comprise younger data set A, or “offshore” samples. Ages obtained from shoreline indicators collected landward from the current shoreline do include potential high-stand indicators. Examples include beach ridge plains. These samples comprise younger data set B, or “onshore” samples. The result is two distinctly different sea-level curves, based on sampling bias. The two data sets are plotted in Figures 6 (younger data set A) and 7 (younger data set B).

The data subset plotted in the upper panel of Figure 7 is of much interest. The data indicate episodic high-stands of sea-level during the mid- to late-Holocene. Some investigators hold that beach ridges are the result of high-energy events, such as storms (*e.g.*, Psuty, 1965, 1966; Reineck and Singh, 1980; Bird, 1984). Arguing against this thesis is the fact that subsequent high-energy, short-term events can easily destroy storm ridges, so that very few survive (*e.g.*, Tanner, 1995; Balsillie, 1995). This distinction is important enough that further discussion is warranted.

Present existence of coastal beach ridge plains (several to over a dozen ridges) is testimony to the abundant supply of sand-sized sediment comprising a local to sub-

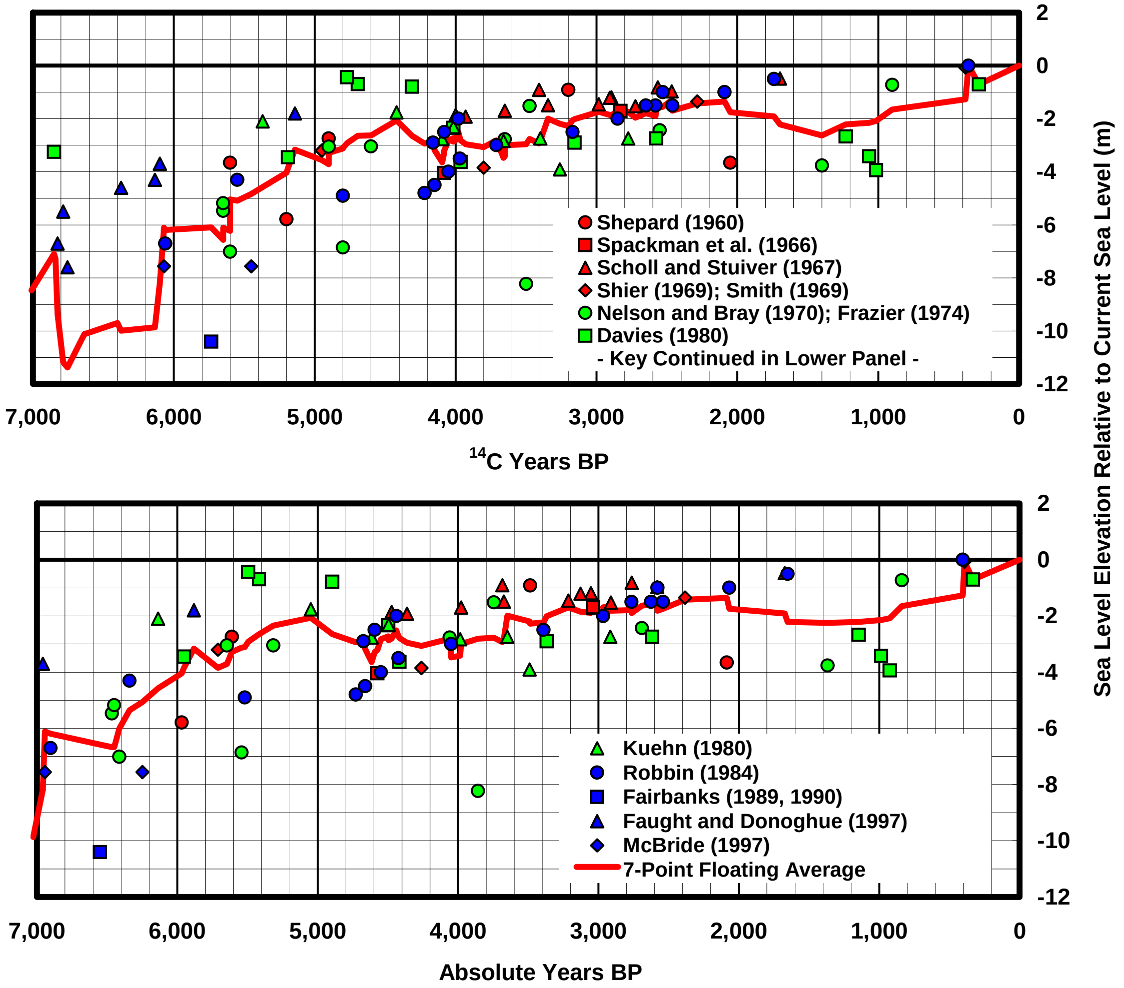

Figure 6. Gulf of Mexico younger data set A for dated sample sets collected offshore from the present shoreline. 7-point floating average curves have been fitted to the ^{14}C and absolute age data sets.

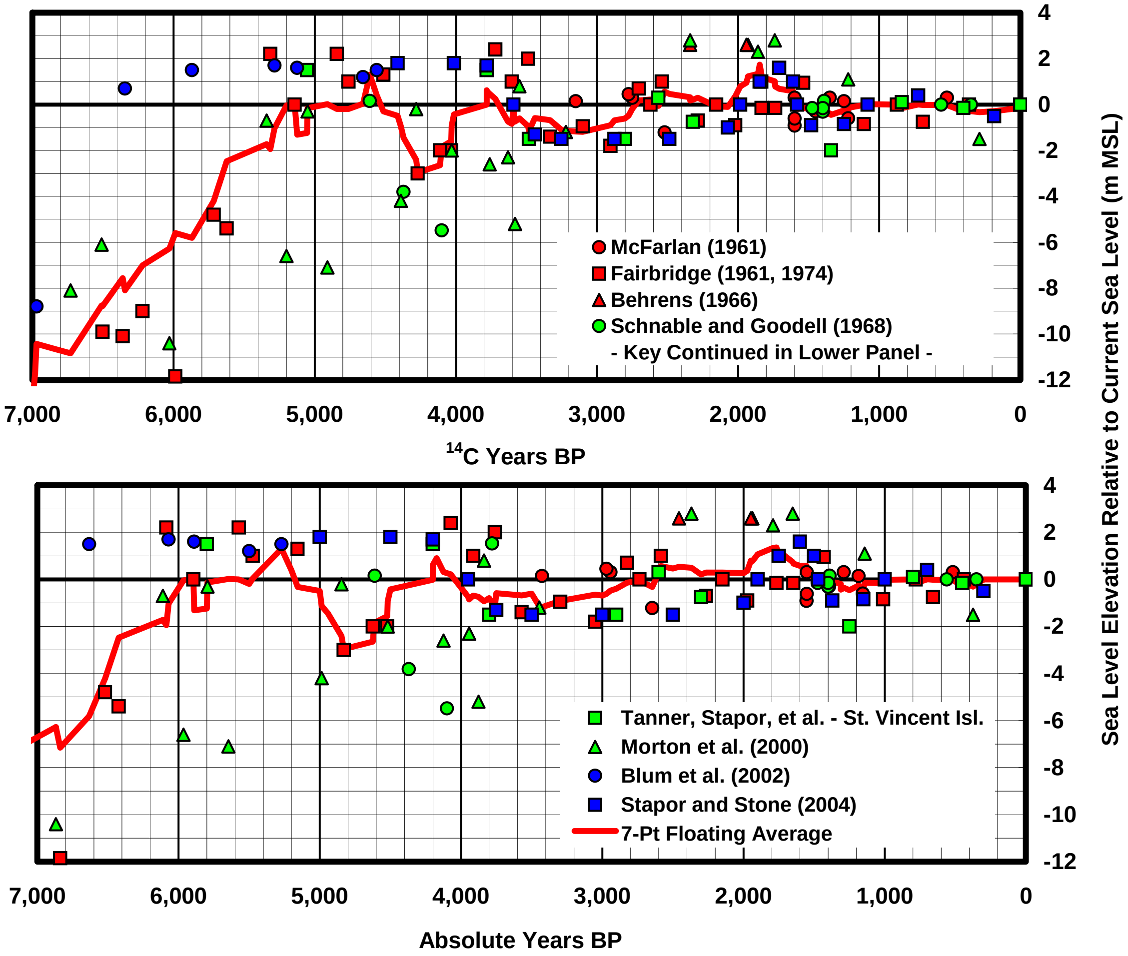

Figure 7. Gulf of Mexico younger data set B for dated sample sets collected onshore from the present shoreline. 7-point floating average curves have been fitted to the ^{14}C and absolute age data sets.

regional littoral drift regime. Because beach ridges are deposited by the combined effects of tidal elevation changes and shore-breaking wave induced run-up transport processes, each ridge in the seaward direction represents a relative change in sea-level. A beach ridge plain may be comprised of beach ridge sets each representing a chapter in sea-level history as gleaned from dating, elevation determinations, and sedimentologic character. There is, however, one process concerning the preservation of upland coastal features such as beach ridge plains that has long been ignored – that of nature's own "seawalls" which afford protection to natural coasts. These "seawalls" are nearshore submerged longshore bars that, unlike the anthropically engineered designs are not fixed but are dynamically mobile.

During shore-incident storm activity, waves shore-propagating upon the rising storm tide induce longshore bar formation (*e.g.*, Bruun, 1963; Hayes, 1972; Dette, 1980; Balsillie, 1984a, 1984b, 1985, 1999; Birkemeier, 1984; Sallenger *et al.*, 1985; Howd and Birkemeier, 1987). Longshore bar formation is largely dependent on the type of shore-breaking wave geometry (e.g., spilling, plunging, surging waves), since wave geometry dictates the direction that sediment will be transported (*e.g.*, Dolan, 1983; Dally, 1987). The relationship between breaker type and sediment characteristics is logically synergistic, resulting in bar size directly proportional to breaker height (Balsillie, 1984a), and can move offshore at rates of over two meters per hour (Howd and Birkemeier, 1987; Sunamura and Maruyama, 1987). Longshore bars, then, cause waves to break further offshore thereby inducing waves to expend the greatest amount of destructive energy they possess. Even when offshore bar-breaking waves reform, their energy is so reduced that by the time they reach shore their erosive capability is greatly diminished (Carter and Balsillie, 1983; Balsillie, 1984b, 1985, 1999). In this way, upland coastal physiography is protected, but only if sufficient sand-sized sediment is available in the littoral zone for longshore bar formation. Coasts with well-developed beach ridge plains would appear to epitomize such sedimentologically abundant characteristics.

The same is not true for storm ridges. They are formed by fast moving storms or hurricanes whose associated storm tide and shore-incident breaking wave activity progressively erodes beach material, transporting it onshore to reside as a washover type deposit (*e.g.*, Schwartz, 1975). This occurs because nearshore slopes are steep enough that breaking wave activity encroaches close enough to shore to cause washover processes to occur (*e.g.*, Hayes, 1972). At the same time, the relatively steep nearshore slope and inadequate sediment supplies disallow the formation of adequate longshore bars to provide coastal protection. In addition, littoral sediment volumes are not sufficient to provide a succession of storm ridge features. Hence, storm deposits are subject to erosion and redistribution when another extreme event impact occurs and few survive to be found in the geologic record.

Moreover, normal beach ridge deposits and storm deposits can be differentiated based on granulometry (*e.g.*, Tanner, 1991a; Balsillie, 1995). In contrast with storm deposits, well-developed low beach ridge plains (0.2 to 0.3 m of ridge relief) represent long-term, ongoing littoral processes during fair-weather conditions. Beach ridges are preserved only when sea-level falls or remains stable. Such sea-level lowering needs to be on the order of only 0.2 m or so to encourage beach ridge formation. (Stapor, 1973, 1975; Stapor and Tanner, 1977; Tanner *et al.* 1989; Tanner, 1989, 1990a, 1990b, 1991a, 1991b, 1992a, 1992b, 1993, 1995; Balsillie, 1995).

For the most part, beach ridge plains of the Gulf of Mexico are quite young, ranging in age from several hundred years to about 6,000 ^{14}C years BP. The idea of such plains as indicators of sea-level has an early historical source (LeBlanc and Bernard, 1954). More recently, many of them have been investigated as they relate to indicators of sea-level high-stands. Stapor and Tanner (1977), Tanner *et al.* (1989), Tanner (1988, 1991a, 1991b ,1992a, 1992b, 1993), and Donoghue and White (1995) studied high-stand evidence from the extensive St. Vincent Island beach ridge plain (western panhandle Gulf coast of Florida). Stapor et al. (1988, 1991) investigated high-stand indicators from beach ridge plains of the southwest Florida Gulf coast (Sanibel Island, Cayo Costa, *etc.*); Walker *et al.* (1995) investigated high-stand archaeological data for the southwest Florida Gulf Coast. Blum *et al.* (2001, 2002) investigated a central Texas coastal beach ridge sequence which yielded significantly older sea-level elevations and dates (corrected here to MSL rather than mean high water, MHW). Stapor and Stone (2004) studied high-stand Louisiana coastal barriers. About beach ridge plains Tanner *et al.* (1989, p. 555) stated "… the sequence, in a well-organized beach ridge plain (such as on St. Vincent Island, Florida) is unmistakable, and permits relative dates from one ridge to the next to be determined fairly closely, typically to better than 50 yrs. Only a few historical or radiometric dates are needed to construct a well-controlled history, because a simple beach ridge system as this one is itself a calendar."

As with the older data set, the two younger data sets have been subjected to a 7-point floating average analyses, for consistency with the older data set. Moving point average curves are given in the lower panel of Figure 6 for younger data set A and in the lower panel of Figure 7 for younger data set B. Some average characteristics of the Gulf of Mexico younger data sets are listed in Table 2. Gulf of Mexico sea-level curve data are listed in Appendix III for younger data set A, and in Appendix IV for younger data set B.

Combined Data Sets

Older and younger data sets are combined and presented in Figure 8 to quantify Gulf of Mexico sea-level ^{14}C (upper panel) and absolute age (lower panel) histories since the last glacial maximum. In addition, the global (eustatic) sea-level curve from Figure 2 (Siddall *et al.,* 2003) is plotted with the Gulf of Mexico regional sea-level history in Figure 9. While there are differences, they are small enough that the Gulf of Mexico data can be said to represent global (eustatic) history for the period since the last glacial maximum. The correlation (r being the correlation coefficient) between the Siddall *et al.*, (2003) global and the Gulf of Mexico data sets are very high at r > 0.99 for both ^{14}C and absolute data plots (Figure 9). Average elevation differences between the global and Gulf of Mexico sea-level curves are 5.14 m for the ^{14}C age data curve, and 5.38 m for the absolute age data curve.

YOUNGER DRYAS

North American Laurentide ice sheet reached maximum ice accumulation by about 18,000 ^{14}C years BP (22,000 absolute years BP), at which time sea level was some 120 m below present mean sea level (Bloom, 1971; Fairbanks, 1989, 1990). The period 11,000 to 10,000 ^{14}C years BP also has been recognized as a signature event during the deglacial era, termed the Younger Dryas. It was, at least in part, a cold period of significant proportions. Three deglacial models (Ruddiman, 1987a, 1987b) have been proposed: 1) a smooth deglaciation scenario with the most rapid melting centered at 11,000 ^{14}C years BP; 2) a two-step model with maximum melting rates from 14,000 to 12,000 ^{14}C years BP and from 10,000 to 7,000 ^{14}C years BP separated by a period with little or no ice volume loss; and 3) a Younger Dryas model involving a period of significant ice growth in the midst of the deglaciation, from approximately 11,000 to 10,000 ^{14}C years BP. Ruddiman (1987a, 1987b) favored the smooth deglaciation model, while Fairbanks (1989) supported the two-step model. While deglaciation scenarios during the time-period involved are at odds, two of the three models suggest a dry period occurring between about 10,900 and 10,500 ^{14}C years BP.

Deep-sea $\delta^{18}O$ records corroborate a two-stage melting scenario. Marine sediment records identify a significant melt-water pulse, MWP-IA, occurring from 14,500 to 11,500 years BP (Duplessy *et al.*, 1981, 1986; Bard *et al.*, 1987). From ^{14}C records of Barbados cores, Fairbanks (1989) found the rate of sea level rise to be a minimum at 11,000 ^{14}C years BP, marking the beginning of the Younger Dryas event which persisted until 10,000 ^{14}C years years BP. The more recent half of the Younger Dryas from 10,500 to 10,000 ^{14}C years BP was characterized by increasing rates of melt-water discharge, culminating in a second melt-water pulse, MWP-IB, at about 9,500 ^{14}C years BP (Fairbanks, 1989). Marine $\delta^{18}O$ records (Baumgartner and Reichel, 1975) indicate that during the older half of the Younger Dryas (11,000 to 10,500 ^{14}C years BP), melt-water discharge rates were less than during MWP-IA by a factor of five, and at least a factor of three less than rates during the MWP-IB melt-water event (Fairbanks, 1989).

A review of the literature (Table 3) from 24 studies provides a consensus of the age of the Younger Dryas at from 11,000 to 10,000 radiocarbon years or 12,800 to 11,400 absolute years BP, the end of which is the approximate Pleistocene – Holocene boundary. Since our representation of the sea level curve is a floating average of existing sea-level data indicators, it is subject to the variability of the available data. Nonetheless, the Younger Dryas appears to be represented in the Gulf of Mexico data (Figs. 8 and 9), as a millennium characterized by a slowing in the rate of sea-level rise. It is also of interest to note in Figure 9 that the greatest deviation between the Gulf of Mexico and the “global” curve occurs during the period of the Younger Dryas, although this

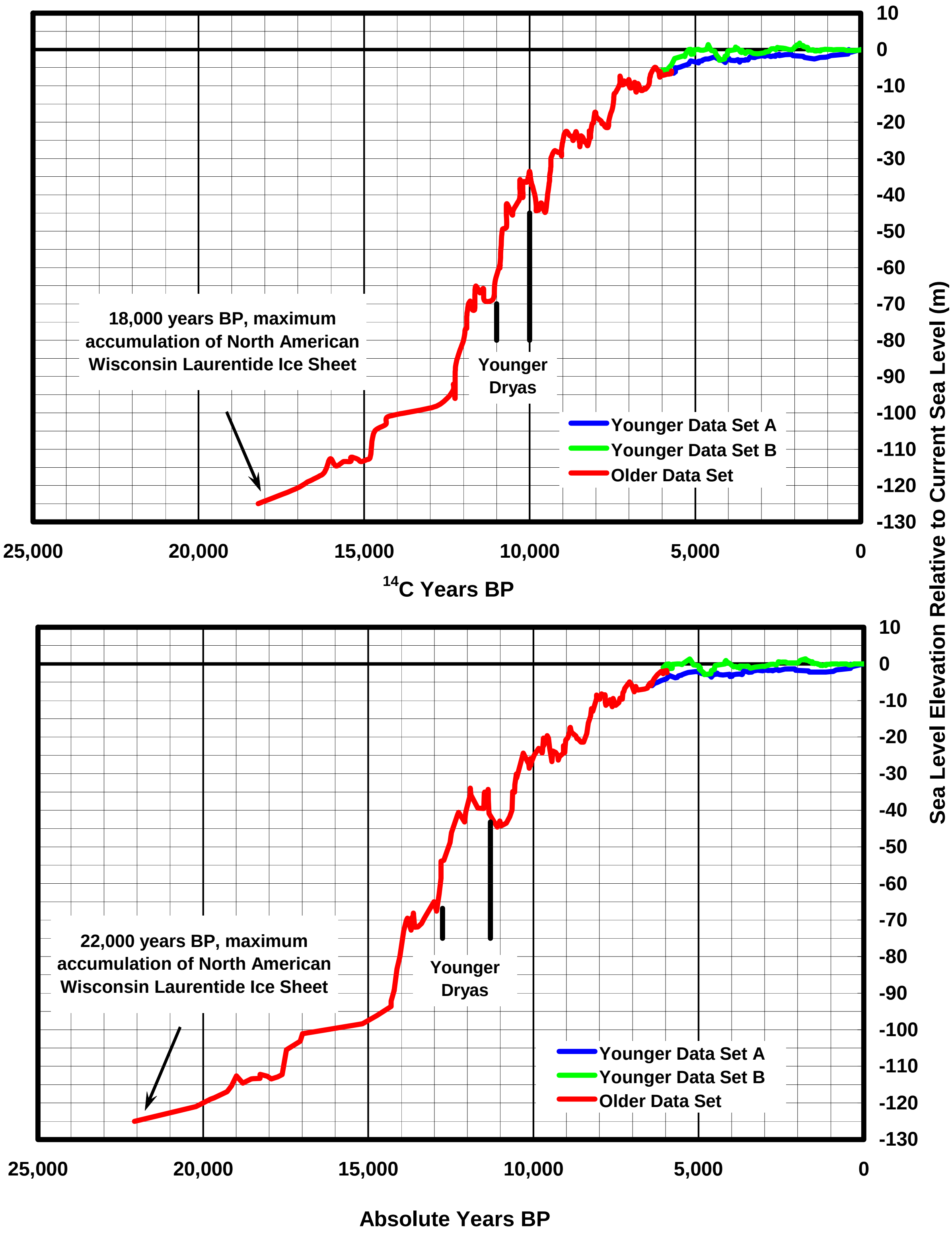

Figure 8. Final combined sea-level curves for the Gulf Mexico.

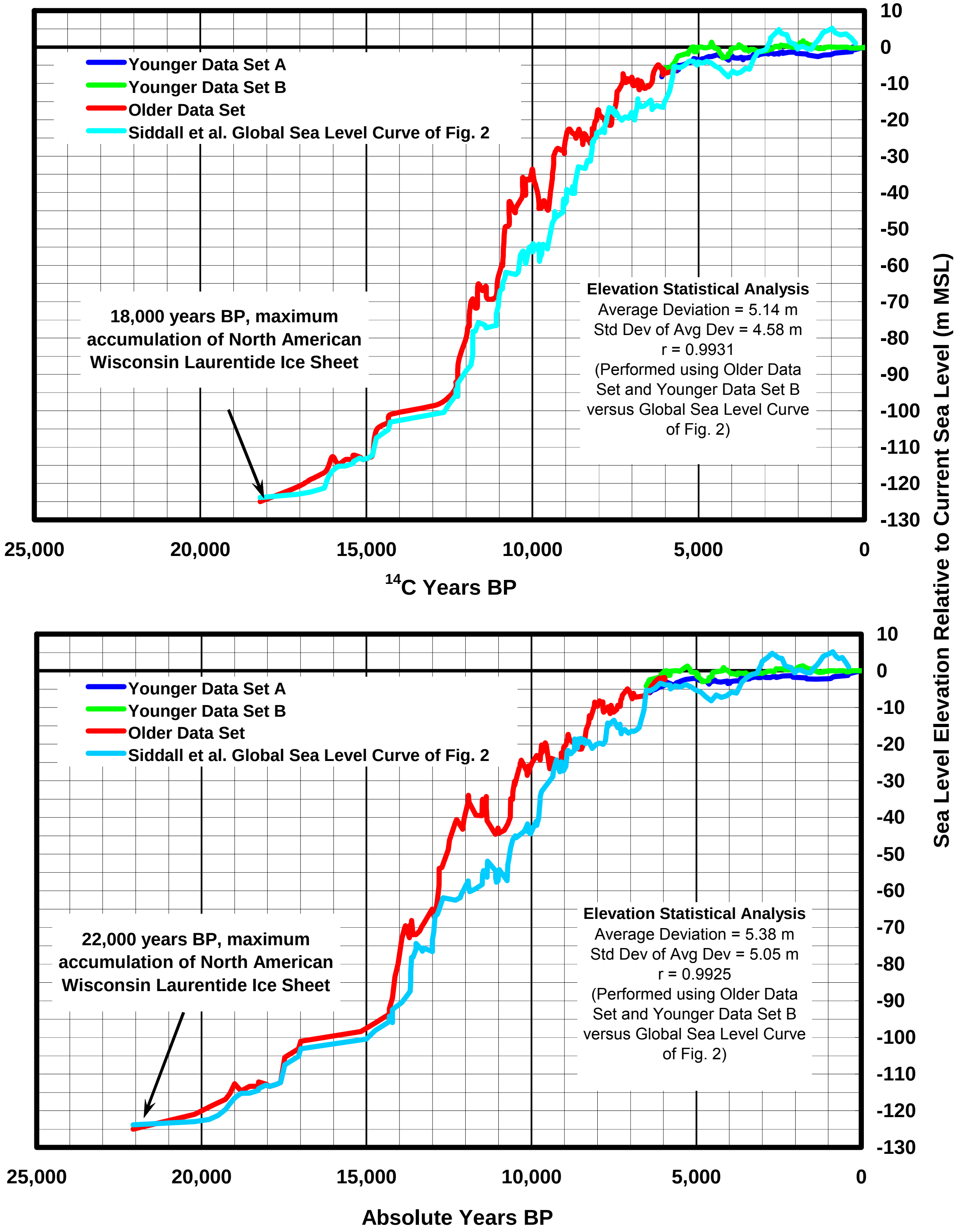

Figure 9. Final combined Gulf of Mexico sea-level curves compared to the Siddall *et al.* (2003) global (eustatic) sea-level curve of Fig. 2.

Table 3. Some delimiting dates for the beginning and end of the Younger Dryas.

Investigator	^{14}C Years BP		Absolute Years BP	
	Beginning	Termination	Beginning	Termination
Becker and Kromer. (1986)				11,300
Hammer *et al.* (1986)				10,720
Fairbanks (1990)	11,000	10,000	13,000	11,700
Flower and Kennett (1990)	11,000	10,000		
Bard *et al*. (1992)				11,350
Bjorck *et al*. (1992)				10,650
Johnsen (1992)				11,550
Kromer and Becker (1992)				11,300
Rozanski *et al*. (1992)				11,350
Zolitschka *at al*. (1992)				10,630
Alley *et al.* (1993)			12,940	11,640
Edwards *et al*. (1993)	11,000	10,250	13,000	11,600
Marchitto and Wei (1995)	11,300	10,100		
Bjorck *et al*. (1996)		9,950	12,600	11,425
Hughen *et al*. (1996)			12,500	11,000
de Vernal *et al.* (1996)	10,800	10,300		
Smith *et al.* (1997)			13,000	11,700
Bennett *et al.* (2000)			13,000	11,200
Muscheler *et al.* (2000)				11,550
Goslar *et al.* (2000)			12,700	11,500
Renssen (2001)				11,500
Dyke *et al*. (2002)	11,000	9,600		
Polyak *et al*. (2004)			12,800	11,640
Means	11,017	10,029	12,780	11,370
Calibration Check[1]	11,017	10,029	12,840	11,450

[1] Calibration check tests ^{14}C year BP means to assure they closely represent absolute year BP means from other studies.

NOTE: All ^{14}C data calibrated to absolute years in this work were calculated using CALIB Rev 4.4.2 using a 390-year reservoir age, a marine ΔR correction of 0 years ± 50 years, and the Marine98 and IntCal98 data sets (references provided in the text).

may be an artifact of the spread of the data available in the older data set within that time period. Note, that when the mean radiocarbon ages for the beginning (11,017 ^{14}C years BP) and the end (10,029 ^{14}C years BP) of the Younger Dryas are calibrated using CALIB 4.4.2, the results, in absolute years, are virtually the same (12,840 years BP and 11,450 years BP) as the means shown in Table 3.

A CLOSER LOOK AT SEA-LEVEL HISTORY FOR THE PAST 6,000 YEARS

Due to its scale, Figure 8 does not reveal fine details for mid- and late-Holocene sea-level behavior. The Gulf of Mexico younger data sets A and B are, therefore, plotted in Figure 10 along with the Siddall *et al.* (2003) global (eustatic) sea-level data for the same period, from Figure 2. The amplitudes in the Siddall *et al.* (2003) curve are potentially exaggerated, with a δ^{18}O uncertainty of ±12 m in sea-level elevation as reported by the authors, but the timing may be compared with that of the Gulf of Mexico data sets.

There is no discernable correlation between the Gulf of Mexico younger data set A ("offshore" samples) and the Siddall *et al.* (2003) global curve (Figure 10, upper panel). There are, however, high-stand phase correlations between the Siddall *et al.* (2003) global and the Gulf of Mexico younger data set B ("onshore" samples). These are identified in the lower panel (absolute age data) of Figure 10. There are five sea-level high stands reflected by the Gulf of Mexico data (labeled *a, c, e, g* and *i*). Four of these

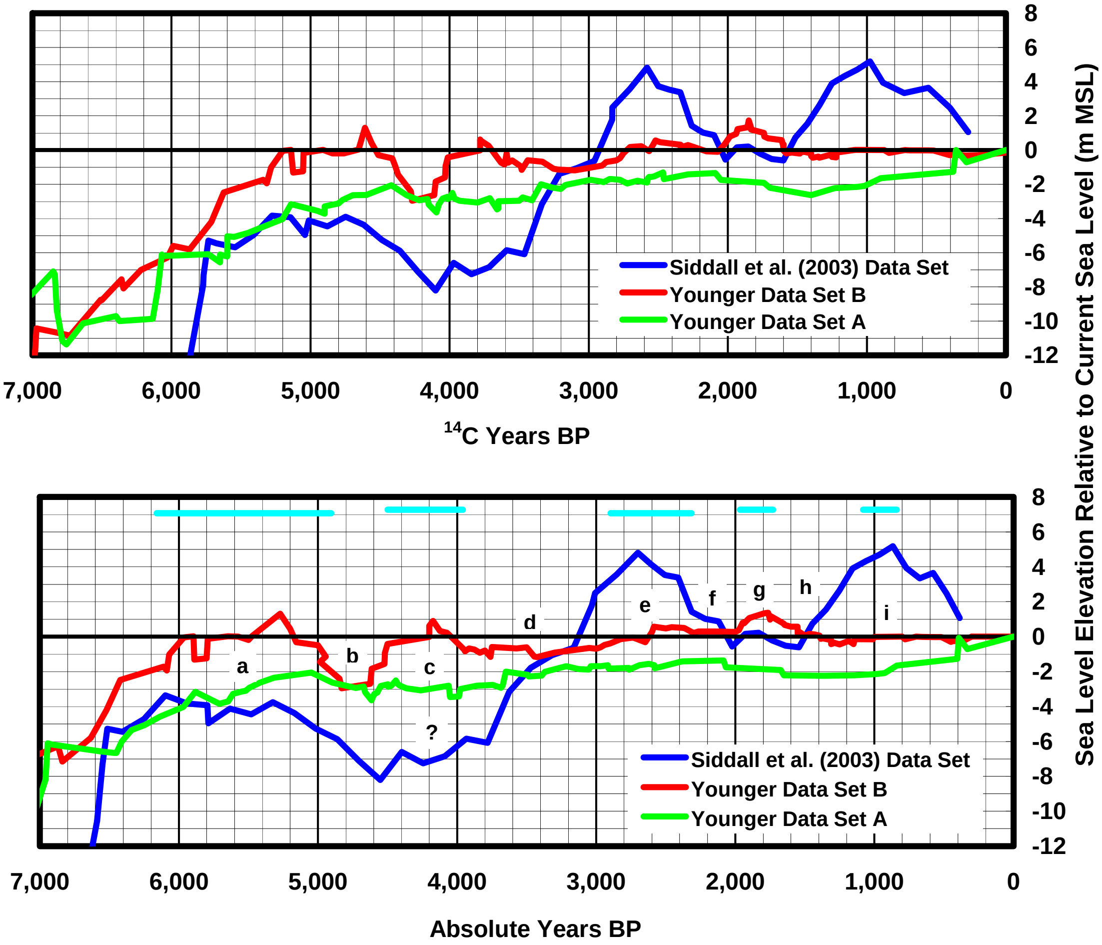

Figure 10. Comparison of Gulf of Mexico younger data sets with the Siddall *et al.* (2003) global (eustatic) sea-level curve. Horizontal bars indicate sea-level high stands. See text for discussion.

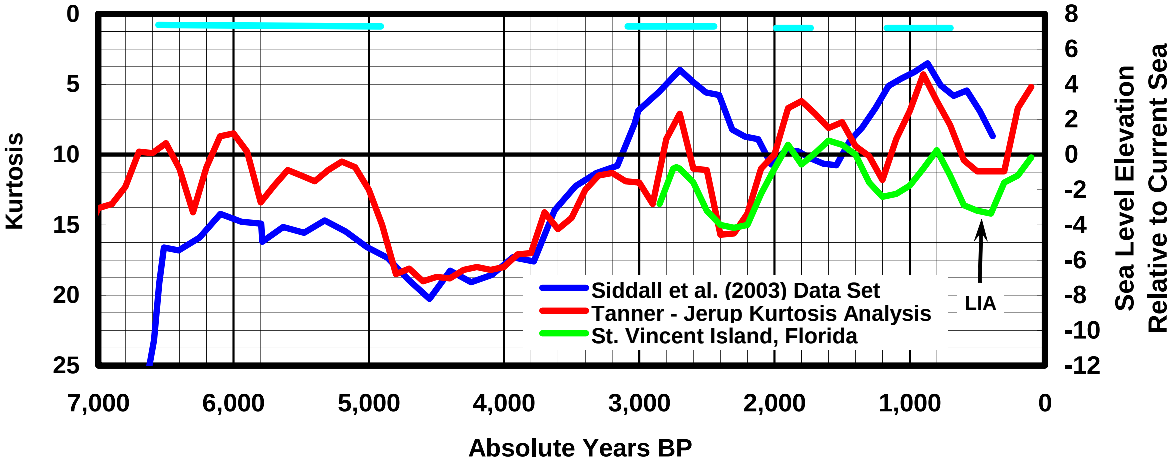

Figure 11. Comparison of Tanner's (1990a, 1991a, 1993) kurtosis as a surrogate indicator of sea-level stands and the Siddall *et al.* (2003) global (eustatic) sea-level curve. Horizontal bars indicate sea-level high stands. See text for discussion. LIA = Little Ice Age.

events (labeled *a, e, g,* and *i*) correlate with periods of high-stand or rapid rise in sea level reflected in the Red Sea record of Siddall *et al.* (2003). The correlation between the Gulf of Mexico and Red Sea data for event *c* (4,500 to 4,000 absolute years BP) is less clear, but both records are associated with the initiation of a period of sea-level rise (4,600 to 4,400 absolute years BP).

Gulf of Mexico sea-level data of Stapor and Tanner (1977), Tanner *et al.* (1989), Tanner (1991a, 1991b, 1992a, 1993), Blum *et al.* (2001, 2002), and Stapor and Stone (2004) suggest a continuous high-stand from 6,400 to 4,000 absolute years BP. Data of Fairbridge (1961, 1974), Schnable and Goodell (1968), and Morton *et al.* (2000) indicate a sea-level low from about 5,000 to 3,700 absolute years BP.

The Siddall *et al.* (2003) data by comparison could indicate a continuous sea-level low-stand from 5,000*e* to 3,700 absolute years BP. Tanner (1990a, 1991a, 1993, *etc*.) found a correlation between transpo-depositional shore-breaking wave energy and the kurtosis moment measure, K, of sediments which are deposited by runup processes, resulting from shore-breaking wave activity. When applied to the Jerup, Denmark, beach ridge plane (~150 ridges) sediments, K becomes a surrogate indicator of sea-level low or high-stands. Tanner's Jerup findings are plotted with the Siddall *et al.* (2003) results in Figure 11 showing remarkable agreement, including agreement indicating a European - Middle Eastern low-stand from 5,000 to 3,700 absolute years BP. There is, however, evidence that in Mesopotamia there was a very abrupt arid period beginning at 4,025 absolute years BP (Cullen *et al.*, 2000) consistent with conditions in Turkey (Lemcke and Sturm, 1997), Israel (Bar-Matthews *et al.*, 1997), the Dead Sea (Frumkin, 1991), Yemen (Wilkinson, 1997), north and east Africa (Gasse and Van Campo, 1994; Halfman and Johnson, 1988), and Morocco (Cheddadi *et al.*, 1998). Claussen *et al.* (1999) suggest this may have been the result of large-scale changes in ocean-atmosphere-vegetation boundary conditions. Cullen *et al.* (2000) noted that the "… event was of uncommonly large amplitude compared to the rest of the Holocene, and it nearly matched the mineralogic and geochemical amplitudes associated with the Younger Dryas aridification*.*" This might suggest the onset of a cooler period that was preceded by a higher sea-level stand.

Hence, four major Gulf of Mexico sea-level high-stands appear to be confirmed relative to the global curve of Siddall *et al.* (2003) with, perhaps, a fifth though less clear high-stand occurring 4,500 to 4,000 absolute years BP.

DISCUSSION

The outcome of this investigation is a new and well-defined sea-level curve for the northern Gulf of Mexico based on a large database of radiocarbon-dated sea-level indicators. The data set appears to be sufficiently dense to accurately define a detailed sea-level history of the Gulf region. On the average, a sea-level elevation measurement occurs once every 53 ^{14}C years for the Gulf of Mexico data (see Table 2). There is, in fact, a sufficient amount of data to clearly illustrate that the most significant issue in this type of investigation is the degree of variability. In smoothing some of the noise, the moving average method might lower the level of detail by removing variability, but enables longer-term trends to be observed.

Future data sets will certainly improve our understanding of late Quaternary sea-level history for the Gulf of Mexico or any other region. Future sampling can be refined by taking into account the possibility of sea-level stands higher than present during the Holocene. Typical sea-level data sets have been strongly biased in favor of low-stand indicators by restricting the sampling to elevations below present sea-level. The difference between Figures 6 and 7 is that the investigations that produced the data sets of Figure 7 sampled beach ridges and other potential high sea- level stand indicators along with low-stand deposits. The possibility of Holocene high- stands of sea-level has generally been dismissed due to the sparsity of data. In recent years, however, new data sets have strengthened the case for Holocene high-stands. An unusual number of such data sets are from the Gulf of Mexico (*e.g.,* Stapor, 1973, 1975; Stapor and Tanner, 1977; Tanner *et al.* 1989; Tanner, 1989, 1990a, 1990b, 1991a, 1991b, 1992a, 1992b, 1993, 1995; Stapor *et al.,* 1988, 1991; Blum *et al.,* 2001, 2002; Walker *et al.*, 1995; Stapor and Stone, 2004), but evidence also comes from other regions (*e.g.,* Tanner, 1990a, 1990b, 1991a, 1993) implying that high-stand events were global in their extent.

By their very nature, sea-level histories will always possess some inherent variability. And so, whether one analyzes the data now or later would appear to make little difference, and the type of analysis conducted in this investigation remains justified. One obvious solution is the discovery and application of new methodologies for assessing the sea-level data, a condition we have introduced here. Necessary data includes details on the dating method and the accuracy of selecting geologically distinguishable stratigraphic horizons that can be identified as representing a verifiable sea-level stand. Errors associated with the ^{14}C dating method have been discussed previously, and need to be quantified to the most detailed extent possible. By comparison, selection of dateable stratigraphic horizons is much less quantifiable, perhaps even qualitative. Given the difference, the scientist must conclude that it is the latter which introduces the bulk of the error and, therefore, the major part of the variability in the data. A case in point involves consideration of younger data sets A and B for ages less than about 6,000 absolute years BP. Just why datable beach ridge plain data (younger data set B) has not been recognized as the more definitive representation of sea-level history, remains enigmatic. It also calls attention as to whether an eustatic sea-level curve might have credence. Note that the Atlantic and Pacific Oceans on either side of the Panama Canal have mean sea-levels differing by but 0.2 m, implying that global sea-level assessments may be applicable.

CONCLUSIONS

Objectives of this work were: 1) to determine a single, comprehensive sea-level curve for the Gulf of Mexico, and 2) to provide evidence that, for stable coastal regions such as the northern Gulf of Mexico, sea-level history approximates global (*i.e.*, eustatic) sea-level, and 3) to present evidence for the occurrence of high-stands of sea-level during the mid- and late-Holocene. Twenty-three data subsets for the Gulf of Mexico from various investigators were employed to determine sea-level changes from about 18,000 to about 400 ^{14}C years BP (*i.e.*, 21,000 to 0 absolute years BP).

Data were divided into three sets – one older than about 6,000 years BP, and two data sets younger than about 6,000 years BP. The two younger data sets distinguished themselves from the older data set because of sampling location. One younger data set was comprised of shoreline indicators collected seaward of the current shoreline that, by definition, do not provide evidence of higher sea-level stands. The other younger data set, comprising sea-level indicators landward of the current shoreline, however, do offer evidence of high sea-level stands. The oldest of these high-stands were older than 6,000 absolute years BP. For all of these data sets it was determined that a relatively simple nth order floating point averaging statistical approach is a proper approach, given the variability of the data. For any sequence of numerical data, the larger the number of data points involved in a sequential floating point average, the smoother the resulting curve. Based on testing, it was found that a 7-point floating average was optimum in that it removes much of the natural noise in the data while retaining enough detail to depict long term sea-level history. Comparison of the resulting composite Gulf of Mexico sea-level curve resulting from this work with the global curve of Siddall *et al.* (2003) indicates sufficient similarity that it can be concluded that the Gulf of Mexico data represents a global or eustatic sea-level history. This also applies to the existence of Holocene high-stand evidence in both data sets. The Gulf of Mexico appears to be one the most reliable sources of evidence for high-stand events during the latter half of the Holocene.

Finally, during the course of this investigation, we faced the problem of identifying Gulf of Mexico sea-level data outliers that can be justifiably excused from inclusion in analytical procedures. This is not, in fact, a problem isolated to Gulf of Mexico data alone, but is normally the case for most data sets as can be easily verified by inspecting the comprehensive world-wide national and regional sea-level compilation of Pirazzoli (1991). Utilizing the eustatic data of Siddall *et al.* (2003), a method has been proposed that might be considered by other researchers as a useful tool for editing of sea-level data.

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APPENDIX I

Dated Sea-Level Data Sets Used in This Study

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Curray (1960)	Texas Gulf of Mexico	Marine shell material	8,030	220	8,902	-11.89				
		Marine shell material	8,680	270	9,659	-16.46				
		Marine shell material	8,740	260	9,737	-26.52				
		Marine shell material	9,460	310	10,645	-49.38				
		Marine shell material	9,530	270	10,716	-30.48				
		Marine shell material	10,000	400	11,474	-36.60				n = 13
		Marine shell material	11,900	340	13,845	-55.78				Abs age calculated using CALIB
		Marine shell material	12,420[a]	420	14,617	-42.06				Rev 4.4.2
		Marine shell material	12,820[a]	390	15,063	-57.61				[a]spurious data
		Marine shell material	12,900	400	15,174	-71.32				
		Marine shell material	12,960[a]	470	15,257	-57.61				
		Marine shell material	15,400[a]	510	18,282	-69.49				
		Marine shell material	16,940[a]	680	20,053	-87.78				
Shepard (1960)	Texas Bays/ Shelf and Louisiana Cheniers	Oyster shells (TX bay)	2,050	200	2,086	-3.66				
		Oyster shells (LA chenier)	3,200	100	3,486	-0.91				
		Oyster shells (LA chenier)	4,900	100	5,611	-2.74				
		Oyster shells (TX bay)	5,200	450	5,969	-5.79				
		Oyster shells (LA chenier)	5,600	100	6,408	-3.66				n = 11
		Oyster shells (TX shelf)	8,600	200	9,547	-21.95				Abs age calculated using CALIB
		Oyster shells (TX bay)	8,950	1,000	10,143	-16.15				Rev 4.4.2
		Oyster shells (TX bay)	9,350	300	10,514	-22.86				
		Oyster shells (TX shelf)	9,400	250	10,572	-45.42				
		Oyster shells (TX bay)	9,800	200	11,093	-27.43				
		Oyster shells (TX shelf)	9,950	300	11,369	-41.15				
McFarlan (1961	Louisiana Gulf Coast beaches and cheniers	*Mulinia* shells	520	100	517	0.30				
		Mulinia shells	1,220	100	1,155	-0.61				
		Mercenaria shells	1,250	105	1,184	0.15				
		Melongena shells	1,350	105	1,290	0.30				
		Busycon shells	1,450	105	1,394	-0.30				
		Dinocardium shells	1,600	120	1,554	-0.91				n = 12
		Busycon shells	1,600	105	1,552	0.30				Abs age calculated using CALIB
		Dinocardium shells	1,600	110	1,552	-0.61				Rev 4.4.2
		Mulinia shells	2,520	110	2,646	-1.22				
		Mulinia shells	2,750	110	2,941	0.30				
		Crassostrea shells	2,775	110	2,969	0.46				
		Crassostrea shells	3,150	120	3,426	0.15				
Fairbridge (1961, 1974)	Eustatic Sea Level Curve	Various materials	0	n/a	0	0.00				
		Various materials	364	n/a	439	0.00				
		Various materials	691	n/a	657	-0.75				
		Various materials	876	n/a	780	0.00				n = 51
		Various materials	1,109	n/a	1,011	-0.85				
		Various materials	1,538	n/a	1,432	0.95				
		Various materials	1,737	n/a	1,647	-0.15				
		Various materials	1,833	n/a	1,765	-0.15				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Fairbridge (1961, 1974)	Eustatic Sea Level Curve	Various materials	2,019	n/a	1,974	-0.90				
		Various materials	2,154	n/a	2,148	0.00				
		Various materials	2,286	n/a	2,264	-0.70				
		Various materials	2,539	n/a	2,584	1.00				
		Various materials	2,622	n/a	2,735	0.00				
		Various materials	2,703	n/a	2,823	0.70				
		Various materials	2,903	n/a	3,049	-1.80				
		Various materials	3,100	n/a	3,297	-0.95				
		Various materials	3,333	n/a	3,571	-1.40				
		Various materials	3,488	n/a	3,760	2.00				
		Various materials	3,604	n/a	3,913	1.00				
		Various materials	3,720	n/a	4,073	2.40				
		Various materials	4,033	n/a	4,522	-2.00				
		Various materials	4,112	n/a	4,624	-2.00				
		Various materials	4,271	n/a	4,830	-3.00				
		Various materials	4,513	n/a	5,157	1.30				
		Various materials	4,760	n/a	5,475	1.00				
		Various materials	4,844	n/a	5,574	2.20				
		Various materials	5,141	n/a	5,895	0.00				
		Various materials	5,315	n/a	6,086	2.20				
		Various materials	5,624	n/a	6,423	-5.40				
		Various materials	5,714	n/a	6,520	-4.80				
		Various materials	5,988	n/a	6,838	-11.85				
		Various materials	6,219	n/a	7,089	-9.00				
		Various materials	6,360	n/a	7,241	-10.10				
		Various materials	6,502	n/a	7,383	-9.90				
		Various materials	6,837	n/a	7,690	-19.00				
		Various materials	7,274	n/a	8,084	-15.10				
		Various materials	7,470	n/a	8,269	-22.20				
		Various materials	7,716	n/a	8,560	-20.10				
		Various materials	7,814	n/a	8,682	-21.00				
		Various materials	8,012	n/a	8,898	-13.00				
		Various materials	8,110	n/a	9,019	-16.00				
		Various materials	8,307	n/a	9,250	-15.00				
		Various materials	8,455	n/a	9,442	-19.50				
		Various materials	8,504	n/a	9,512	-19.00				
		Various materials	9,040	n/a	10,166	-30.00				
		Various materials	9,136	n/a	10,308	-29.00				
		Various materials	9,842	n/a	11,346	-40.00				
		Various materials	10,293	n/a	12,044	-31.50				
		Various materials	11,363	n/a	13,386	-48.00				
		Various materials	11,660	n/a	13,703	-46.00				
		Various materials	11,941	n/a	14,044	-51.00				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	$^{230}Th/^{234}U$ Age (yrs BP)	$^{230}Th/^{234}U$ ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Spackman *et al.* (1966)	SW Florida Gulf Coast	Rhizophora	2,830	170	3,039	-1.71				n = 2; Abs age calculated using CALIB Rev 4.4.2
		Basal Freshwater	4,080	180	4,574	-4.04				
Behrens (1966)	Eastern Mexico Gulf Coast	*Mulinia* sp.	1,930	80	1,936	2.60				n = 3 Abs age calculated using CALIB Rev 4.4.2
		Mulinia sp.	1,940	60	1,947	2.60				
		Mercenaria sp.	2,340	100	2,457	2.60				
Scholl and Stuvier (1967)	SW Florida Gulf Coast	Marine shells	1,698	220	1,674	-0.48				n = 12 Abs age calculated using CALIB Rev 4.4.2
		Marine shells	2,466	168	2,581	-0.97				
		Marine shells	2,565	190	2,763	-0.82				
		Calcitic mud	2,724	288	2,911	-1.53				
		Mangrove and fresh-water peat	2,894	273	3,053	-1.19				
		Marine shells	2,905	275	3,127	-1.21				
		Mangrove peat	2,985	169	3,215	-1.46				
		Mangrove peat	3,344	245	3,674	-1.49				
		Fresh-water peat	3,408	271	3,685	-0.91				
		Fresh-water peat	3,650	125	3,978	-1.70				
		Fresh-water peat	3,930	265	4,365	-1.92				
		Fresh-water peat	4,000	125	4,473	-1.86				
Schnable and Goodell (1968)	Florida Apalachicola Gulf Coast	Wood stump	350	120	377	0.00				n = 11 Abs age calculated using CALIB Rev 4.4.2
		Wood stump	560	110	569	0.00				
		Wood in sandy peat	1,390	175	1,298	0.15				
		Sandy peat	1,400	105	1,311	-0.30				
		Sandy peat	1,400	105	1,311	-0.15				
		Sandy peat	1,475	105	1,385	-0.15				
		Wood in sandy peat	3,780	330	4,173	1.52				
		Crassostrea virginica	4,100	110	4,614	-5.49				
		Crassostrea virginica	4,370	420	4,943	-3.81				
		Wood in sandy peat	4,610	625	5,201	0.15				
		Rangia cuneata	9,950	180	11,502	-22.10				
Shier (1969)	Florida Ten Thousand Islands	Fibrous mangrove peat	380	150	393	-0.08				n = 3 Abs age calculated using CALIB Rev 4.4.2
		Fibrous mangrove peat	2,285	150	2,382	-1.35				
		Fibrous mangrove peat	3,800	150	4,261	-3.85				
Smith (1969)	SW Florida Gulf Coast	Rhizophora	4,950	120	5,710	-3.20				n = 1; Abs age calculated using CALIB Rev 4.4.2
Nelson and Bray (1970)	Texas Gulf Coast	Peat	3,475		3,739	-1.52				n = 11 Abs age calculated using CALIB Rev 4.4.2
		Peat	4,900		5,646	-3.05				
		Peat	5,650		6,450	-5.18				
		Peat	6,635	200	7,508	-22.02				
		Peat	7,840	250	8,715	-22.17				
		Peat	7,975	200	8,850	-21.64				
		Wood	8,660	230	9,728	-19.66				
		Peat	8,880	350	9,981	-19.66				
		Peat	9,370	300	10,630	22.33				
		Peat	10,207	347	11,919	-35.66				
		Peat	10,320	298	12,085	-21.95				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Frazier (1974)	NW Gulf of Mexico	Brackish-marsh peat	900	125	838	-0.73				n = 27 Abs age calculated using CALIB Rev 4.4.2 [a]spurious data
		Bay pelecypods	1,400	350	1,368	-3.76				
		Brackish-marsh peat	2,550	110	2,691	-2.44				
		Bay pelecypods	3,500	115	3,859	-8.23				
		Brackish-marsh peat	3,650	120	4,060	-2.77				
		Brackish-marsh peat	4,600	125	5,316	-3.05				
		Bay pelecypods	4,800	140	5,542	-6.86				
		Bay pelecypods	5,600	140	6,412	-7.01				
		Brackish-marsh peat	5,650	140	6,465	-5.47				
		Brackish-marsh peat	7,025	160	7,867	-7.54				
		Bay pelecypods	7,150	160	7,993	-15.09				
		Brackish-marsh peat	7,240	160	8,083	-12.19				
		Bay pelecypods	8,150	180	9,052	-20.18				
		Inner-neritic pelecypods	8,400	150	9,328	-35.17				
		Inner-neritic pelecypods	8,700	200	9,685	-22.25				
		Inner-neritic pelecypods	8,800	180	9,841	-28.96				
		Wood and brackish-marsh peat	9,250	210	10,388	-16.15				
		Wood and brackish-marsh peat	10,525	215	12,269	-35.05				
		Brackish-marsh peat	10,700	150	12,525	-42.67				
		Inner-neritic pelecypods	10,700	220	12,481	-53.19				
		Inner-neritic pelecypods	11,050	300	12,933	-65.53				
		Inner-neritic pelecypods	11,900	250	13,816	-69.80				
		Bay pelecypods	12,960[a]	450	15,259	-57.61				
		Inner-neritic pelecypods	15,575	500	18,483	-106.47				
		Inner-neritic pelecypods	16,600	420	19,661	-100.86				
		Inner-neritic pelecypods	16,940[a]	680	20,053	-87.78				
		Bay pelecypods	19,400[a]	510	22,837	-49.38				
Stapor and Tanner (1977); Tanner *et al.* (1989); Tanner (1991a, 1991b, 1992a, 1993)	St. Vincent Island, Florida	See Notes	0	0	0	0.00				n = 11 Abs age calculated using CALIB Rev 4.4.2 Data were extracted from a published sea level curve based on granulometric data of Tanner (1992, fig. 4; 1993, fig. 6). Age control points were based on archaeological evidence and marine ^{14}C dates.
			405	3	450	-0.15				
			841	18	800	0.10				
			1,342	26	1,250	-2.00				
			1,835	33	1,750	1.00				
			2,320	36	2,300	-0.75				
			2,566		2,600	0.30				
			2,802	48	2,900	-1.50				
			3,482	56	3,800	-1.50				
			3,781		4,200	1.50				
			5,054		5,800	1.50				
Davies (1980)	Florida Gulf Coast	Avicennia	285	100	332	-0.71				n = 15 Abs age calculated using CALIB Rev 4.4.2
		Rhizophora Avicennia	1,015	85	926	-3.94				
		Rhizophora	1,065	160	987	-3.42				
		Avicennia	1,230	80	1,147	-2.67				
		Basal Freshwater	2,575	100	2,616	-2.74				
		Basal Freshwater	3,155	100	3,369	-2.90				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Davies (1980)	Florida Gulf Coast	Transitional Conocarpus	3,965	70	4,417	-3.63				
		Freshwater	4,015	100	4,497	-2.34				
		Basal Freshwater	4,310	100	4,897	-0.79				
		Basal Freshwater	4,695	105	5,417	-0.70				
		Basal Freshwater	4,770	100	5,494	-0.44				
		Basal Freshwater	5,190	100	5,952	-3.45				
		Basal Freshwater	6,850	80	9,646	-3.25				
		Organics	7,400	115	8,205	-0.79				
		Rhizophora Avicennia	7,450	165	8,243	-4.90				
Kuehn (1980)	SW Florida Gulf Coast	Rhizophora	2,775	200	2,916	-2.74				
		Rhizophora	3,260	65	3,490	-3.91				
		Marine Marl contact	3,399	(102)1	3,649	-2.74				n = 8
		Brackish	3,660	85	3,986	-2.83				Abs age calculated using CALIB
		Basal Freshwater	4,015	80	4,495	-2.32				Rev 4.4.2
		Rhizophora	4,095	75	4,615	-2.77				1 ^{14}C error calculated as
		Basal Untyped	4,420	200	5,048	-1.77				0.03 14C age
		Basal Freshwater	5,370	80	6,136	-2.10				
Robbin (1984)	Florida Keys	Peat	360	60	405	0.00				
		Peat	1,740	60	1,652	-0.50				
		Peat	2,090	90	2,068	-1.00				
		Peat	2,460	(74)2	2,541	-1.50				
		Peat	2,530	80	2,579	-1.00				
		Peat	2,580	70	2,626	-1.50				
		Peat	2,650	90	2,765	-1.50				
		Peat	2,850	60	2,967	-2.00				
		Peat	3,170	70	3,392	-2.50				
		Peat	3,710	70	4,050	-3.00				n = 25
		Peat	3,970	100	4,425	-3.50				Abs age calculated using CALIB
		Peat	3,980	80	4,440	-2.00				Rev 4.4.2
		Peat	4,050	90	4,550	-4.00				1 ^{14}C error calculated as
		Peat	4,080	90	4,595	-2.50				0.03 14C age
		Peat	4,150	150	4,662	-4.50				[a]spurious date
		Peat	4,160	140	4,673	-2.90				
		Peat	4,220	80	4,728	-4.80				
		Peat	4,800	100	5,519	-4.90				
		Peat	5,550	(167)1	6,340	-4.30				
		Peat	6,060	60	6,903	-6.70				
		Crust	7,280	130	8,090	-7.20				
		Peat	7,595	85	8,384	-7.20				
		Peat	8,010	165	8,882	-7.40				
		Crust	13,740[a]	140	16,493	-9.20				
		Crust	14,700[a]	400	17,603	-9.20				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Fairbanks (1989, 1990)	Barbados	Corals	5,735	80	6,550	-10.40				n = 56 Abs age calculated using CALIB Rev 4.4.2
		Corals	6,400	100	7,307	-19.99	7,457	41		
		Corals	6,840	70	7,689	-13.00				
		Corals	7,500	100	8,341	-28.20	9,249	42		
		Corals	7,630	80	8,483	-29.69				
		Corals	7,780	110	8,655	-21.15	8,449	24		
		Corals	8,010	75	8,891	-24.34				
		Corals	8,080	180	8,959	-28.20				
		Corals	8,160	110	9,041	-28.20				
		Corals	8,195	115	9,094	-25.07				
		Corals	8,200	100	9,091	-28.20	9,285	47		
		Corals	8,338	71	9,260	-29.69				
		Corals	8,700	100	9,691	-33.19				
		Corals	9,050	125	10,090	-33.09	9,734	24		
		Corals	9,080	100	10,118	-40.84				
		Corals	9,400	100	10,563	-43.90	11,094	37		
		Corals	9,730	200	10,978	-57.92				
		Corals	9,760	160	11,016	-56.42				
		Corals	9,800	100	11,087	-57.92	11,526	37		
		Corals	10,100	100	11,479	-56.42	11,587	30		
		Corals	10,300	100	11,911	-61.21	12,263	43		
		Corals	10,500	100	12,299	-63.99				
		Corals	10,900	200	12,795	-65.96				
		Corals	10,900	100	12,855	-69.19	13,226	56		
		Corals	11,100	200	13,013	-86.00				
		Corals	11,400	100	13,276	-72.95				
		Corals	11,500	100	13,326	-72.95				
		Corals	11,640	140	13,499	-69.19				
		Corals	11,720	200	13,592	-73.85				
		Corals	11,800	100	13,637	-73.85	13,804	69		
		Corals	11,800	200	13,664	-92.61	14,234	50		
		Corals	11,850	100	13,677	-73.41	13,703	87		
		Corals	12,000	210	13,928	-98.06				
		Corals	12,200	100	14,134	-96.64				
		Corals	12,250	100	14,214	-93.71				
		Corals	12,250	100	14,214	-94.96				
		Corals	12,300	120	14,308	-93.69				
		Corals	12,300	120	14,308	-96.80				
		Corals	12,500	100	14,733	-98.06	14,656	82		
		Corals	14,280	160	16,992	-106.90				
		Corals	14,340	150	17,061	-110.83				
		Corals	14,700	200	17,476	-111.19	18,241	71		
		Corals	14,815	280	17,609	-112.36				
		Corals	14,930	200	17,741	-111.19				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	$^{230}Th/^{234}U$ Age (yrs BP)	$^{230}Th/^{234}U$ ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Fairbanks (1989, 1990)	Barbados	Corals	15,100	160	17,937	-114.28				
		Corals	15,200	200	18,053	-119.13				
		Corals	15,390	200	18,271	-111.19				
		Corals	15,400	200	18,283	-114.60	18,895	46		
		Corals	15,630	170	18,548	-108.40				
		Corals	15,851	127	18,801	-119.13				
		Corals	16,020	210	18,996	-114.60				
		Corals	16,145	131	19,139	-119.48				
		Corals	16,260	210	19,271	-119.48	19,035	46		
		Corals	16,700	300	19,776	-125.44	20,807	60		
		Corals	17,085	260	20,218	-119.48	18,985	46		
		Corals	18,200	200	22,080	-130.57	21,933	74		
Edwards et al. (1993)	New Guinea	Corals	7,550	140	8,403	-9.20	8,363	71		
		Corals	7,750	270	8,611	-15.90	8,760	51		
		Corals	8,730	120	9,740	-24.90	9,642	72		
		Corals	9,300	140	10,463	-33.70	10,490	77		
		Corals	9,530	120	10,696	-37.30	10,673	25		
		Corals	9,790	120	11,070	-40.50	10,955	54		n = 13
		Corals	9,990	90	11,334	-42.40	11,045	57		Abs age calculated using CALIB
		Corals	10,090	80	11,456	-42.00	10,912	27		Rev 4.4.2
		Corals	10,200	130	11,700	-46.50	12,332	39		
		Corals	10,410	120	12,127	-47.00	12,155	56		
		Corals	10,430	140	12,158	-42.90	12,084	70		
		Corals	10,970	110	12,920	-57.50	13,129	84		
		Corals	10,980	110	12,928	-54.80	12,837	68		
Schroeder *et al.* (1995)	NE Gulf of Mexico	Oyster shells	8,480	90	9,407	-26.80				
		Oyster shells	8,980	800	10,129	-25.30				
		Oyster shells	9,040	90	10,079	-25.45				
		Oyster shells	9,360	80	10,509	-31.20				n = 10
		Oyster shells	9,650	110	10,824	-30.20				Abs age calculated using CALIB
		Oyster shells	10,100	120	11,491	-35.05				Rev 4.4.2
		Oyster shells	10,290	130	11,889	-33.55				[a]spurious date
		Oyster shells	10,820	150	12,715	-40.45				
		Oyster shells	10,860	120	12,801	-40.45				
		Oyster shells	15,240[a]	90	18,099	-40.40				
Bard *et al.* (1996)	Tahiti	Corals	2,830	90	3,032	-0.50				
		Corals	5,040	90	5,795	-2.00				
		Corals	5,770	100	6,588	-7.10				
		Corals	6,035	100	6,904	-8.00				
		Corals	6,360	100	7,269	-9.50				
		Corals	6,410	120	7,313	-12.00				
		Corals	6,820	120	7,676	-15.80				n = 34
		Corals	6,910	120	7,758	-17.30				Abs age calculated using CALIB
		Corals	7,830	140	8,695	-26.50				Rev 4.4.2

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
		Corals	7,830	200	8,688	-26.00	8,520	40		
		Corals	8,170	180	9,082	-35.00	9,263	45		
		Corals	8,410	140	9,334	-37.00	9,572	37		
		Corals	8,730	140	9,738	-41.00				
		Corals	8,790	120	9,838	-40.00	9,830	45		
		Corals	8,800	120	9,855	-42.50	9,920	40		
		Corals	8,970	140	10,029	-47.10	10,250	40		
		Corals	8,990	120	10,044	-46.90	10,193	45		
		Corals	9,070	120	10,109	-49.00	10,120	50		
		Corals	9,080	200	10,137	-49.00	10,120	50		
		Corals	9,330	140	10,494	-50.00	10,575	50		
Bard *et al*. (1996)	Tahiti	Corals	9,550	140	10,714	-56.00	10,850	50		
		Corals	9,580	140	10,741	-56.00	10,850	50		
		Corals	9,800	140	11,086	-59.20	11,280	30		
		Corals	9,980	140	11,345	-65.00	11,495	30		
		Corals	10,280	140	11,870	-65.50	11,930	50		
		Corals	10,800	160	12,679	-72.20	12,800	30		
		Corals	10,830	140	12,735	-72.10	12,875	40		
		Corals	11,010	160	12,942	-73.60	12,695	60		
		Corals	11,030	160	12,958	-75.60	12,865	50		
		Corals	11,090	160	13,005	-74.40	12,710	50		
		Corals	11,090	160	13,005	-76.50	12,905	50		
		Corals	11,430	200	13,303	-77.30	13,065	30		
		Corals	11,630	220	13,502	-80.60	13,473	55		
		Corals	11,790	220	13,660	-83.70	13,740	53		
		Wood in marine sand	5,140	100	5,882	-1.80				
		Wood in marine sand	6,100	60	6,958	-3.70				
		Crassostrea shell (marine)	6,135	80	7,026	-4.30				
		Crassostrea shell (marine)	6,375	80	7,288	-4.60				
Faught and Donoghue (1997)	NE Gulf of Mexico	Wood in sandy clay (terrestrial)	6,755	60	7,611	-7.60				n = 11
		Wood in silty clay (brackish)	6,785	80	7,613	-5.50				Abs age calculated using CALIB
		Wood in silty clay (brackish)	6,825	120	7,681	-6.70				Rev 4.4.2
		Wood in sandy clay (terrestrial)	7,010	80	7,827	-7.30				
		Wood in sandy clay (terrestrial)	7,130	75	7,939	-6.40				
		Wood in sandy clay (terrestrial)	7,160	95	7,969	-7.00				
		Quercus stump (terrestrial)	7,240	100	8,051	-4.30				
		Mercenaria sp.	5,450	80	6,248	-7.56				
		Chione canellata	6,070	60	6,944	-7.56				
		Oliva sayana	8,610	60	9,584	-35.04				n = 8
McBride (1997)	NE Gulf of Mexico	Chione canellata	10,040	50	11,371	-31.57				Abs age calculated using CALIB
		Chione canellata	10,040	60	11,382	-31.78				Rev 4.4.2
		Chione canellata	10,070	60	11,422	-31.78				[a]spurious date
		Chione canellata	10,200	60	11,681	-31.78				
		Nuculana concentrica	12,600[a]	60	14,779	-25.91				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Morton *et al*., (2000)	Texas Gulf Coast	Peat	290	50	375	-1.50				n = 25 Abs age calculated using CALIB Rev 4.4.2
		Rangia	1,220	50	1,142	1.10				
		Crassostrea	1,740	60	1,652	2.80				
		Crassostrea	1,860	60	1,790	2.30				
		Crassostrea	2,340	60	2,368	2.80				
		Mulinia, Anadara	3,220	80	3,445	-1.20				
		Anadara, Mulinia	3,550	90	3,837	0.80				
		Crassostrea	3,580	70	3,876	-5.20				
		Mulinia, Anadara	3,630	60	3,943	-2.30				
		Peat	3,760	60	4,124	-2.60				
		Organic clay and peat	4,030	90	4,519	-2.00				
		Mixed shells	4,280	50	4,846	-0.20				
		Organic clay	4,390	70	4,986	-4.20				
		Mulinia, Crassostrea	4,910	60	5,647	-7.10				
Morton *et al*., (2000)	Texas Gulf Coast	Mixed shells	5,050	90	5,794	-0.30				
		Mulinia, Crassostrea	5,200	70	5,965	-6.60				
		Anadara, Mulinia	5,340	120	6,111	-0.70				
		Crassostrea	6,030	70	6,868	-10.40				
		Rangia	6,510	90	7,413	-6.10				
		Peat	6,730	80	7,590	-8.10				
		Wood and organic clay	6,980	160	7,808	-13.90				
		Peat	7,020	80	7,835	-8.30				
		Rangia	8,250	160	9,214	-24.10				
		Peat	8,740	60	9,737	-20.50				
		Wood	8,970	170	10,071	-20.80				
Blum *et al*. (2001)	Texas Gulf Coast	Foraminifera	4,560	95	5,271	1.50				n = 8 Abs age calculated using CALIB Rev 4.4.2
		Foraminifera	4,656	75	5,499	1.20				
		Foraminifera	5,125	55	5,890	1.60				
		Foraminifera	5,285	55	6,070	1.70				
		Foraminifera	5,870	95	6,633	1.50				
		Foraminifera	6,345	55	7,263	0.70				
		Carbonized plant fragments	6,970	65	7,789	-8.80				
		Carbonized plant fragments	7,010	60	7,828	-8.80				
Siddall *et al.* (2003)	Red Sea and Global Sea Level Curve	Foraminifera		n/a	96	-9.70			0	n = 87 ^{14}C ACP = AMS radiocarbon age control points.
		Foraminifera		n/a	193	-1.01			0	
		Foraminifera		n/a	289	9.66			0	
		Foraminifera		n/a	386	0.89			0	
		Foraminifera		n/a	482	2.99			40	
		Foraminifera		n/a	578	3.34			175	
		Foraminifera		n/a	675	1.23			290	
		Foraminifera		n/a	771	0.18			391	
		Foraminifera		n/a	868	7.19			483	
		Foraminifera		n/a	964	7.54			567	
		Foraminifera		n/a	1,060	5.08			648	

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Siddall *et al.* (2003)	Red Sea and Global Sea Level Curve	Foraminifera		n/a	1,157	11.75			728	
		Foraminifera		n/a	1,253	-0.11			810	
		Foraminifera		n/a	1,350	-1.33			893	
		Foraminifera		n/a	1,446	-2.82			980	
		Foraminifera		n/a	1,542	-1.66			1,071	
		Foraminifera		n/a	1,639	-0.12			1,167	
		Foraminifera		n/a	1,735	-0.49			1,267	
		Foraminifera		n/a	1,832	2.26			1,371	
		Foraminifera		n/a	1,928	0.50			1,479	
		Foraminifera		n/a	2,024	0.85			1,590	
		Foraminifera		n/a	2,121	0.15			1,704	
		Foraminifera		n/a	2,217	-1.99			1,820	
		Foraminifera		n/a	2,313	-5.26			1,938	
		Foraminifera		n/a	2,410	9.62			2,056	
		Foraminifera (^{14}C ACP)	2,720	n/a	n/a	n/a			n/a	
		Foraminifera		n/a	2,506	3.30			2,837	
		Foraminifera		n/a	2,603	3.30			2,884	
		Foraminifera		n/a	2,699	14.53			2,933	
		Foraminifera		n/a	2,854	1.19			3,014	
		Foraminifera		n/a	3,008	2.24			3,099	
		Foraminifera		n/a	3,162	0.83			3,190	
		Foraminifera		n/a	3,317	-4.12			3,284	
		Foraminifera		n/a	3,471	-1.70			3,383	
		Foraminifera		n/a	3,626	-2.43			3,487	
		Foraminifera		n/a	3,780	-1.70			3,595	
		Foraminifera		n/a	3,935	-2.87			3,706	
		Foraminifera		n/a	4,089	-10.17			3,822	
		Foraminifera		n/a	4,244	-19.61			3,942	
		Foraminifera		n/a	4,398	-2.45			4,065	
		Foraminifera		n/a	4,553	-8.69			4,192	
		Foraminifera		n/a	4,707	-5.30			4,323	
		Foraminifera		n/a	4,861	2.90			4,457	
		Foraminifera		n/a	5,016	-14.12			4,593	
		Foraminifera		n/a	5,170	-2.46			4,733	
		Foraminifera		n/a	5,325	-11.00			4,875	
		Foraminifera		n/a	5,479	1.84			5,020	
		Foraminifera		n/a	5,634	-2.47			5,167	
		Foraminifera		n/a	5,788	-0.94			5,316	
		Foraminifera		n/a	5,943	-11.78			5,467	
		Foraminifera		n/a	6,097	-8.38			5,620	
		Foraminifera		n/a	6,252	-3.76			5,774	
		Foraminifera		n/a	6,406	2.52			5,930	
		Foraminifera		n/a	6,515	0.76			6,040	
		Foraminifera		n/a	6,624	-10.62			6,151	

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
Siddall *et al.* (2003)	Red Sea and Global Sea Level Curve	Foraminifera		n/a	6,734	-22.58			6,263	
		Foraminifera		n/a	6,843	-26.57			6,374	
		Foraminifera (^{14}C ACP)	6,420	n/a	n/a	n/a			n/a	
		Foraminifera		n/a	6,952	-23.68			6,486	
		Foraminifera		n/a	7,061	-15.85			6,598	
		Foraminifera		n/a	7,170	-8.74			6,710	
		Foraminifera		n/a	7,280	-26.58			6,823	
		Foraminifera		n/a	7,389	-27.64			6,935	
		Foraminifera		n/a	7,498	-2.51			7,047	
		Foraminifera		n/a	7,607	-3.79			7,159	
		Foraminifera		n/a	7,716	-25.47			7,270	
		Foraminifera		n/a	7,825	-21.89			7,382	
		Foraminifera		n/a	7,935	-15.87			7,493	
		Foraminifera		n/a	8,044	-24.46			7,604	
		Foraminifera		n/a	8,153	-22.30			7,714	
		Foraminifera		n/a	8,262	-10.65			7,824	
		Foraminifera		n/a	8,371	-24.78			7,933	
		Foraminifera		n/a	8,481	-14.49			8,042	
		Foraminifera		n/a	8,590	-14.19			8,150	
		Foraminifera		n/a	8,699	-6.21			8,257	
		Foraminifera		n/a	8,808	-20.19			8,364	
		Foraminifera		n/a	8,917	-26.92			8,470	
		Foraminifera		n/a	9,026	-19.71			8,575	
		Foraminifera		n/a	9,136	-13.16			8,679	
		Foraminifera		n/a	9,245	-24.79			8,783	
		Foraminifera		n/a	9,354	-11.85			8,886	
		Foraminifera		n/a	9,782	-52.86			9,278	
		Foraminifera (^{14}C ACP)	9,390	n/a	n/a	n/a			n/a	
		Foraminifera		n/a	10,209	-39.59			9,656	
		Foraminifera		n/a	10,637	-61.76			10,019	
		Foraminifera		n/a	11,065	-75.52			10,366	
		Foraminifera		n/a	11,492	-71.32			10,697	
		Foraminifera		n/a	11,920	-73.87			11,016	
		Foraminifera (^{14}C ACP)	12,790	n/a	n/a	n/a			n/a	
		Foraminifera		n/a	15,000	-85.64			13,111	
		Foraminifera (^{14}C ACP)	14,630	n/a	n/a	n/a			n/a	
		Foraminifera		n/a	19,500	-120.00			16,928	
Stapor and Stone (2004), Stapor *et al*. (1991), and Walker et al. (1995)	Louisiana and SW Florida Gulf Coast	Shell material	186	21	300	-0.50				n = 19 Data were extracted from sea level curve of Stapor and Stone (in press, fig. 11). ^{14}C dates > 2000 abs years BP are from transformation equiation determined from date scale of Stapor and Stone
		Shell material	725	34	700	0.40				
		Shell material	1,083	43	1,000	0.00				
		Shell material	1,250	48	1,150	-0.85				
		Shell material	1,481	55	1,370	-0.90				
		Shell material	1,581	58	1,470	0.00				
		Shell material	1,611	59	1,500	1.00				

Investigator(s)	Location	Material Dated	^{14}C Age (yrs BP)	^{14}C ± Error	Absolute Age (yrs BP)	Depth Relative to Current MSL (m)	^{230}Th/^{234}U Age (yrs BP)	^{230}Th/^{234}U ± Error	Abs Age based on OIS Boundaries (yrs BP)	Notes
		Shell material	1,708	61	1,600	1.60				(in press, fig. 8). ^{14}C dates < 2000 abs years BP are from transformation equiation from data from CALIB Rev 4.4..2 ^{14}C error assessed as 0.03 ^{14}C years.
		Shell material	1,848	65	1,750	1.00				
		Shell material	1,984	69	1,900	0.00				
		Shell material	2,072	71	2,000	-1.00				
		Shell material	2,488	n/a	2,500	-1.50				
		Shell material	2,876	n/a	3,000	-1.50				
Stapor and Stone (2004), Stapor *et al.* (1991), and Walker et al. (1995)	Louisiana and SW Florida Gulf Coast	Shell material	3,252	n/a	3,500	-1.50				
		Shell material	3,440	n/a	3,750	-1.30				
		Shell material	3,591	n/a	3,950	0.00				
		Shell material	3,781	n/a	4,200	1.70				
		Shell material	4,013	n/a	4,500	1.80				
		Shell material	4,412	n/a	5,000	1.80				

OIS = Oxygen Isotope Stage

APPENDIX II

Gulf of Mexico Total Data Set: 7-Point Floating Average Sea-Level Curve

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Data younger than ~6,000 yrs BP: combined younger data set.)
(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Fairbridge (1961, 1974)	0	0.00	0.00	Fairbridge (1961, 1974)	0	0.00	0.00
St. Vincent Island, FL[1]	0	0.00	0.00	St. Vincent Island, FL[1]	0	0.00	0.00
Stapor and Stone (2004)	186	-0.50	-0.5	Stapor and Stone (2004)	300	-0.50	-0.5
Davies (1980)	285	-0.71	-0.39	Davies (1980)	332	-0.71	-0.40
Morton *et al.* (2000)	290	-1.50	-0.39	Morton et al. (2000)	375	-1.50	-0.40
Schnable and Goodell (1968)	350	0.00	-0.40	Schnable and Goodell (1968)	377	0.00	-0.40
Robbin (1984)	360	0.00	-0.35	Shier (1969)	393	-0.08	-0.35
Fairbridge (1961, 1974)	364	0.00	-0.20	Robbin (1984)	405	0.00	-0.20
Shier (1969)	380	-0.08	0.01	Fairbridge (1961, 1974)	439	0.00	0.01
St. Vincent Island, FL[1]	405	-0.15	-0.10	St. Vincent Island, FL[1]	450	-0.15	-0.10
McFarlan (1961)	520	0.30	-0.04	McFarlan (1961)	517	0.30	-0.03
Schnable and Goodell (1968)	560	0.00	-0.02	Schnable and Goodell (1968)	569	0.00	-0.03
Fairbridge (1961, 1974)	691	-0.75	-0.01	Fairbridge (1961, 1974)	657	-0.75	-0.01
Stapor and Stone (2004)	725	0.40	-0.10	Stapor and Stone (2004)	700	0.40	-0.10
St. Vincent Island, FL[1]	841	0.10	-0.70	Fairbridge (1961, 1974)	780	0.00	-0.70
Fairbridge (1961, 1974)	876	0.00	-1.19	St. Vincent Island, FL[1]	800	0.10	-1.19
Frazier (1974)	900	-0.73	-1.08	Frazier (1974)	838	-0.73	-1.08
Davies (1980)	1,015	-3.94	-1.26	Davies (1980)	926	-3.94	-1.26
Davies (1980)	1,065	-3.42	-1.36	Davies (1980)	987	-3.42	-1.11
Stapor and Stone (2004)	1,083	0.00	-1.21	Stapor and Stone (2004)	1,000	0.00	-1.50
Fairbridge (1961, 1974)	1,109	-0.85	-1.48	Fairbridge (1961, 1974)	1,011	-0.85	-1.52
McFarlan (1961)	1,220	-0.61	-0.90	Morton et al. (2000)	1,142	1.10	-1.04
Morton *et al.* (2000)	1,220	1.10	-0.53	Davies (1980)	1,147	-2.67	-0.53
Davies (1980)	1,230	-2.67	-0.82	Stapor and Stone (2004)	1,150	-0.85	-0.82
McFarlan (1961)	1,250	0.15	-0.65	McFarlan (1961)	1,155	-0.61	-0.65
Stapor and Stone (2004)	1,250	-0.85	-0.54	McFarlan (1961)	1,184	0.15	-0.79
St. Vincent Island, FL[1]	1,342	-2.00	-0.75	St. Vincent Island, FL[1]	1,250	-2.00	-0.45
McFarlan (1961)	1,350	0.30	-0.39	McFarlan (1961)	1,290	0.30	-0.35
Schnable and Goodell (1968)	1,390	0.15	-0.94	Schnable and Goodell (1968)	1,298	0.15	-0.80
Schnable and Goodell (1968)	1,400	-0.30	-0.87	Schnable and Goodell (1968)	1,311	-0.30	-0.95
Schnable and Goodell (1968)	1,400	-0.15	-0.60	Schnable and Goodell (1968)	1,311	-0.15	-0.69
Frazier (1974)	1,400	-3.76	-0.78	Frazier (1974)	1,368	-3.76	-0.77
McFarlan (1961)	1,450	-0.30	-0.66	Stapor and Stone (2004)	1,370	-0.90	-0.66
Schnable and Goodell (1968)	1,475	-0.15	-0.62	Schnable and Goodell (1968)	1,385	-0.15	-0.62
Stapor and Stone (2004)	1,481	-0.90	-0.73	McFarlan (1961)	1,394	-0.30	-0.45
Fairbridge (1961, 1974)	1,538	0.95	-0.15	Fairbridge (1961, 1974)	1,432	0.95	0.13
Stapor and Stone (2004)	1,581	0.00	-0.19	Stapor and Stone (2004)	1,470	0.00	0.17
McFarlan (1961)	1,600	-0.91	-0.02	Stapor and Stone (in press)	1,500	1.00	0.06
McFarlan (1961)	1,600	0.30	0.04	McFarlan (1961)	1,552	0.30	0.33
McFarlan (1961)	1,600	-0.61	0.13	McFarlan (1961)	1,552	-0.61	0.18
Stapor and Stone (2004)	1,611	1.00	0.11	McFarlan (1961)	1,554	-0.91	0.10
Scholl and Stuiver (1967)	1,698	-0.48	0.17	Stapor and Stone (2004)	1,600	1.60	0.36
Stapor and Stone (2004)	1,708	1.60	0.52	Fairbridge (1961, 1974)	1,647	-0.15	0.25
Fairbridge (1961, 1974)	1,737	-0.15	0.59	Robbin (1984)	1,652	-0.50	0.48
Robbin (1984)	1,740	-0.50	0.59	Morton et al. (2000)	1,652	2.80	0.75
Morton *et al.* (2000)	1,740	2.80	0.80	Scholl and Stuiver (1967)	1,674	-0.48	0.50
Fairbridge (1961, 1974)	1,833	-0.15	0.90	St. Vincent Island, FL[1]	1,750	1.00	0.85
St. Vincent Island, FL[1]	1,835	1.00	1.29	Stapor and Stone (2004)	1,750	1.00	0.92
Stapor and Stone (2004)	1,848	1.00	1.74	Fairbridge (1961, 1974)	1,765	-0.15	0.90
Morton *et al.* (2000)	1,860	2.30	1.34	Morton et al. (2000)	1,790	2.30	1.34
Behrens (1966)	1,930	2.60	1.23	Stapor and Stone (2004)	1,900	0.00	1.06
Behrens (1966)	1,940	2.60	0.56	Behrens (1966)	1,936	2.60	0.78
Stapor and Stone (2004)	1,984	0.00	0.28	Behrens (1966)	1,947	2.60	0.66
Fairbridge (1961, 1974)	2,019	-0.90	-0.19	Fairbridge (1961, 1974)	1,974	-0.90	-0.19
Shepard (1960)	2,050	-3.66	-0.57	Stapor and Stone (2004)	2,000	-1.00	-0.19
Stapor and Stone (2004)	2,072	-1.00	-1.13	Robbin (1984)	2,068	-1.00	-0.67

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Data younger than ~6,000 yrs BP: combined younger data set.)
(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Robbin (1984)	2,090	-1.00	-1.23	Shepard (1960)	2,086	-3.66	-1.14
Fairbridge (1961, 1974)	2,154	0.00	-1.21	Fairbridge (1961, 1974)	2,148	0.00	-0.62
Shier (1969)	2,285	-1.35	-0.31	Fairbridge (1961, 1974)	2,264	-0.70	-0.67
Fairbridge (1961, 1974)	2,286	-0.70	0.23	St. Vincent Island, FL[1]	2,300	-0.75	-0.15
St. Vincent Island, FL[1]	2,320	-0.75	0.16	Morton et al. (2000)	2,368	2.80	0.16
Behrens (1966)	2,340	2.60	0.02	Shier (1969)	2,382	-1.35	-0.06
Morton *et al.* (2000)	2,340	2.80	0.00	Behrens (1966)	2,457	2.60	-0.10
Robbin (1984)	2,460	-1.50	-0.08	Stapor and Stone (2004)	2,500	-1.50	-0.13
Scholl and Stuiver (1967)	2,466	-0.97	-0.11	Robbin (1984)	2,541	-1.50	-0.39
Stapor and Stone (2004)	2,488	-1.50	-0.34	Robbin (1984)	2,579	-1.00	-0.15
McFarlan (1961)	2,520	-1.22	-1.09	Scholl and Stuiver (1967)	2,581	-0.97	-0.92
Robbin (1984)	2,530	-1.00	-0.99	Fairbridge (1961, 1974)	2,584	1.00	-0.92
Fairbridge (1961, 1974)	2,539	1.00	-0.81	St. Vincent Island, FL[1]	2,600	0.30	-0.88
Frazier (1974)	2,550	-2.44	-0.99	Davies (1980)	2,616	-2.74	-1.08
Scholl and Stuiver (1967)	2,565	-0.82	-1.03	Robbin (1984)	2,626	-1.50	-0.94
St. Vincent Island, FL[1]	2,566	0.30	-0.89	McFarlan (1961)	2,646	-1.22	-1.20
Davies (1980)	2,575	-2.74	-1.24	Frazier (1974)	2,691	-2.44	-1.46
Robbin (1984)	2,580	-1.50	-0.79	Fairbridge (1961, 1974)	2,735	0.00	-0.97
Fairbridge (1961, 1974)	2,622	0.00	-0.90	Scholl and Stuiver (1967)	2,763	-0.82	-0.97
Robbin (1984)	2,650	-1.50	-0.89	Robbin (1984)	2,765	-1.50	-1.01
Fairbridge (1961, 1974)	2,703	0.70	-0.90	St. Vincent Island, FL[1]	2,823	0.70	-1.06
Scholl and Stuiver (1967)	2,724	-1.53	-0.62	St. Vincent Island, FL[1]	2,900	-1.50	-1.01
McFarlan (1961)	2,750	0.30	-0.83	Scholl and Stuiver (1967)	2,911	-1.53	-1.18
Kuehn (1980)	2,775	-2.74	-0.86	Kuehn (1980)	2,916	-2.74	-0.90
McFarlan (1961)	2,775	0.46	-1.25	McFarlan (1961)	2,941	0.30	-1.22
St. Vincent Island, FL[1]	2,802	-1.50	-1.24	Robbin (1984)	2,967	-2.00	-1.25
Spackman *et al*. (1966)	2,830	-1.71	-1.46	McFarlan (1961)	2,969	0.46	-1.28
Robbin (1984)	2,850	-2.00	-1.32	Stapor and Stone (2004)	3,000	-1.50	-1.06
Stapor and Stone (2004)	2,876	-1.50	-1.56	Spackman et al. (1966)	3,039	-1.71	-1.28
Scholl and Stuiver (1967)	2,894	-1.19	-1.55	Fairbridge (1961, 1974)	3,049	-1.80	-1.20
Fairbridge (1961, 1974)	2,903	-1.80	-1.44	Scholl and Stuiver (1967)	3,053	-1.19	-1.40
Scholl and Stuiver (1967)	2,905	-1.21	-1.14	Scholl and Stuiver (1967)	3,127	-1.21	-1.60
Scholl and Stuiver (1967)	2,985	-1.46	-1.34	Scholl and Stuiver (1967)	3,215	-1.46	-1.72
Fairbridge (1961, 1974)	3,100	-0.95	-1.52	Fairbridge (1961, 1974)	3,297	-0.95	-1.44
McFarlan (1961)	3,150	0.15	-1.40	Davies (1980)	3,369	-2.90	-1.44
Davies (1980)	3,155	-2.90	-1.40	Robbin (1984)	3,392	-2.50	-1.40
Robbin (1984)	3,170	-2.50	-1.40	McFarlan (1961)	3,426	0.15	-1.75
Shepard (1960)	3,200	-0.91	-1.82	Morton et al. (2000)	3,445	-1.20	-1.82
Morton *et al.* (2000)	3,220	-1.20	-2.05	Shepard (1960)	3,486	-0.91	-1.61
Stapor and Stone (2004)	3,252	-1.50	-1.84	Kuehn (1980)	3,490	-3.91	-1.64
Kuehn (1980)	3,260	-3.91	-1.88	Stapor and Stone (2004)	3,500	-1.50	-1.88
Fairbridge (1961, 1974)	3,333	-1.40	-1.88	Fairbridge (1961, 1974)	3,571	-1.40	-1.84
Scholl and Stuiver (1967)	3,344	-1.49	-1.89	Kuehn (1980)	3,649	-2.74	-1.92
Kuehn (1980)	3,399	-2.74	-1.90	Scholl and Stuiver (1967)	3,674	-1.49	-1.55
Scholl and Stuiver (1967)	3,408	-0.91	-1.55	Scholl and Stuiver (1967)	3,685	-0.91	-1.05
Stapor and Stone (2004)	3,440	-1.30	-1.07	Nelson and Bray (1970)	3,745	-1.52	-1.07
Nelson and Bray (1970)	3,475	-1.52	-2.03	Stapor and Stone (2004)	3,750	-1.30	-0.56
St. Vincent Island, FL[1]	3,482	-1.50	-1.52	Fairbridge (1961, 1974)	3,760	2.00	-1.52
Fairbridge (1961, 1974)	3,488	2.00	-2.14	St. Vincent Island, FL[1]	3,800	-1.50	-2.14
Frazier (1974)	3,500	-8.23	-1.95	Morton et al. (2000)	3,837	0.80	-1.78
Morton *et al.* (2000)	3,550	0.80	-1.59	Frazier (1974)	3,859	-8.23	-1.92
Morton *et al.* (2000)	3,580	-5.20	-1.70	Morton et al. (2000)	3,876	-5.20	-2.20
Stapor and Stone (2004)	3,591	0.00	-2.39	Fairbridge (1961, 1974)	3,913	1.00	-2.23
Fairbridge (1961, 1974)	3,604	1.00	-1.45	Morton et al. (2000)	3,943	-2.30	-2.75
Morton *et al.* (2000)	3,630	-2.30	-1.97	Stapor and Stone (2004)	3,950	0.00	-2.00
Frazier (1974)	3,650	-2.77	-1.66	Scholl and Stuiver (1967)	3,978	-1.70	-1.66

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
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(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Scholl and Stuiver (1967)	3,650	-1.70	-1.32	Kuehn (1980)	3,986	-2.83	-1.46
Kuehn (1980)	3,660	-2.83	-1.83	Robbin (1984)	4,050	-3.00	-1.50
Robbin (1984)	3,710	-3.00	-1.28	Frazier (1974)	4,060	-2.77	-1.28
Fairbridge (1961, 1974)	3,720	2.40	-0.64	Fairbridge (1961, 1974)	4,073	2.40	-0.83
Morton *et al.* (2000)	3,760	-2.60	-0.19	Morton et al. (2000)	4,124	-2.60	-0.18
Schnauble and Goodell (1968)	3,780	1.52	-0.33	Schnable and Goodell (1968)	4,173	1.52	-0.30
Stapor and Stone (2004)	3,781	1.70	-0.18	St. Vincent Island, FL[1]	4,200	1.50	-0.18
St. Vincent Island, FL[1]	3,781	1.50	-1.04	Stapor and Stone (2004)	4,200	1.70	-1.04
Shier (1969)	3,800	-3.85	-1.17	Shier (1969)	4,261	-3.85	-1.17
Scholl and Stuiver (1967)	3,930	-1.92	-1.67	Scholl and Stuiver (1967)	4,365	-1.92	-1.67
Davies (1980)	3,965	-3.63	-2.18	Davies (1980)	4,417	-3.63	-2.15
Robbin (1984)	3,970	-3.50	-2.14	Robbin (1984)	4,425	-3.50	-2.73
Robbin (1984)	3,980	-2.00	-1.92	Robbin (1984)	4,440	-2.00	-2.51
Scholl and Stuiver (1967)	4,000	-1.86	-1.98	Scholl and Stuiver (1967)	4,473	-1.86	-1.98
Stapor and Stone (2004)	4,013	1.80	-1.75	Kuehn (1980)	4,495	-2.32	-1.75
Davies (1980)	4,015	-2.34	-1.53	Davies (1980)	4,497	-2.34	-1.53
Kuehn (1980)	4,015	-2.32	-1.82	Stapor and Stone (2004)	4,500	1.80	-1.82
Morton *et al.* (2000)	4,030	-2.00	-1.91	Morton et al. (2000)	4,519	-2.00	-2.13
Fairbridge (1961, 1974)	4,033	-2.00	-2.74	Fairbridge (1961, 1974)	4,522	-2.00	-2.15
Robbin (1984)	4,050	-4.00	-2.80	Robbin (1984)	4,550	-4.00	-2.60
Robbin (1984)	4,080	-2.50	-3.26	Spackman et al. (1966)	4,574	-4.04	-3.26
Spackman *et al*. (1966)	4,080	-4.04	-3.26	Robbin (1984)	4,595	-2.50	-3.26
Kuehn (1980)	4,095	-2.77	-3.61	Schnable and Goodell (1968)	4,614	-5.49	-3.61
Schnable and Goodell (1968)	4,100	-5.49	-3.46	Kuehn (1980)	4,615	-2.77	-3.46
Fairbridge (1961, 1974)	4,112	-2.00	-3.79	Fairbridge (1961, 1974)	4,624	-2.00	-3.57
Robbin (1984)	4,150	-4.50	-3.64	Robbin (1984)	4,662	-4.50	-3.64
Robbin (1984)	4,160	-2.90	-3.27	Robbin (1984)	4,673	-2.90	-2.88
Robbin (1984)	4,220	-4.80	-2.60	Robbin (1984)	4,728	-4.80	-2.60
Fairbridge (1961, 1974)	4,271	-3.00	-2.86	Fairbridge (1961, 1974)	4,830	-3.00	-2.86
Morton *et al.* (2000)	4,280	-0.20	-2.81	Morton et al. (2000)	4,846	-0.20	-2.81
Davies (1980)	4,310	-0.79	-2.14	Davies (1980)	4,897	-0.79	-2.14
Schnable and Goodell (1968)	4,370	-3.81	-1.71	Schnable and Goodell (1968)	4,943	-3.81	-1.71
Morton *et al.* (2000)	4,390	-4.20	-1.10	Morton et al. (2000)	4,986	-4.20	-1.10
Stapor and Stone (2004)	4,412	1.80	-0.85	Stapor and Stone (2004)	5,000	1.80	-1.04
Kuehn (1980)	4,420	-1.77	-1.17	Kuehn (1980)	5,048	-1.77	-0.72
Fairbridge (1961, 1974)	4,513	1.30	-0.61	Fairbridge (1961, 1974)	5,157	1.30	-0.61
Blum *et al.* (2001)	4,560	1.50	0.16	Schnable and Goodell (1968)	5,201	0.15	-0.11
Frazier (1974)	4,600	-3.05	-0.19	Blum *et al.* (2001)	5,271	1.50	-0.22
Schnable and Goodell (1968)	4,610	0.15	0.20	Frazier (1974)	5,316	-3.05	-0.03
Blum *et al.* (2001)	4,656	1.20	-0.05	Davies (1980)	5,417	-0.70	-0.05
Davies (1980)	4,695	-0.70	-1.24	Fairbridge (1961, 1974)	5,475	1.00	-0.77
Fairbridge (1961, 1974)	4,760	1.00	-1.51	Davies (1980)	5,494	-0.44	-1.96
Davies (1980)	4,770	-0.44	-1.21	Blum *et al.* (2001)	5,499	1.20	-1.21
Frazier (1974)	4,800	-6.86	-1.82	Robbin (1984)	5,519	-4.90	-1.51
Robbin (1984)	4,800	-4.90	-2.11	Frazier (1974)	5,542	-6.86	-2.08
Fairbridge (1961, 1974)	4,844	2.20	-3.27	Fairbridge (1961, 1974)	5,574	2.20	-3.04
Nelson and Bray (1970)	4,900	-3.05	-3.66	Shepard (1960)	5,611	-2.74	-3.66
Shepard (1960)	4,900	-2.74	-2.73	Nelson and Bray (1970)	5,646	-3.05	-3.01
Morton *et al.* (2000)	4,910	-7.10	-1.81	Morton et al. (2000)	5,647	-7.10	-1.81
Smith (1969)	4,950	-3.20	-1.90	Smith (1969)	5,710	-3.20	-2.38
Morton *et al.* (2000)	5,050	-0.30	-1.72	Morton et al. (2000)	5,794	-0.30	-1.76
St. Vincent Island, FL[1]	5,054	1.50	-1.33	St. Vincent Island, FL[1]	5,800	1.50	-1.33
Blum *et al.* (2001)	5,125	1.60	-0.81	Faught and Donoghue (1997)	5,882	-1.80	-0.81
Faught and Donoghue (1997)	5,140	-1.80	-1.18	Blum et al. (2001, 2002)	5,890	1.60	-1.29
Fairbridge (1961, 1974)	5,141	0.00	-2.08	Fairbridge (1961, 1974)	5,895	0.00	-2.08
Davies (1980)	5,190	-3.45	-2.05	Davies (1980)	5,952	-3.45	-2.39

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
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^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Shepard (1960)	5,200	-5.79	-1.96	Morton et al. (2000)	5,965	-6.60	-1.89
Morton *et al.* (2000)	5,200	-6.60	-1.81	Shepard (1960)	5,969	-5.79	-1.81
Blum *et al.* (2001)	5,285	1.70	-2.11	Morton et al. (2000)	6,111	-0.70	-2.11
Fairbridge (1961, 1974)	5,315	2.20	-2.69	Blum *et al.* (2001)	6,070	1.70	-2.69
Morton *et al.* (2000)	5,340	-0.70	-2.48	Fairbridge (1961, 1974)	6,086	2.20	-2.36
Kuehn (1980)	5,370	-2.10	-2.06	Kuehn (1980)	6,136	-2.10	-2.06
McBride (1997)	5,450	-7.56	-3.30	McBride (1997)	6,248	-7.56	-2.96
Robbin (1984)	5,550	-4.30	-4.39	Robbin (1984)	6,340	-4.30	-3.98
Shepard (1960)	5,600	-3.66	-5.03	Shepard (1960)	6,408	-3.66	-5.03
Frazier (1974)	5,600	-7.01	-5.51	Frazier (1974)	6,412	-7.01	-5.51
Fairbridge (1961, 1974)	5,624	-5.40	-5.12	Fairbridge (1961, 1974)	6,423	-5.40	-5.12
Nelson and Bray (1970)	5,650	-5.18	-5.99	Nelson and Bray (1970)	6,450	-5.18	-5.99
Frazier (1974)	5,650	-5.47	-5.25	Frazier (1974)	6,465	-5.47	-5.25
Fairbridge (1961, 1974)	5,714	-4.80	-5.94	Fairbridge (1961, 1974)	6,520	-4.80	-5.94
Fairbanks (1989, 1990)	5,735	-10.40	-6.66	Fairbanks (1989, 1990)	6,550	-10.40	-6.66
Blum *et al.* (2001)	5,870	1.50	-6.87	Blum *et al.* (2001)	6,633	1.50	-6.87
Fairbridge (1961, 1974)	5,988	-11.85	-7.17	Fairbridge (1961, 1974)	6,838	-11.85	-7.17
Morton *et al.* (2000)	6,030	-10.40	-7.02	Morton et al. (2000)	6,868	-10.40	-7.02
Robbin (1984)	6,060	-6.70	-6.14	Robbin (1984)	6,903	-6.70	-6.14
McBride (1997)	6,070	-7.56	-7.64	McBride (1997)	6,944	-7.56	-7.64
Faught and Donoghue (1997)	6,100	-3.70	-5.85	Faught and Donoghue (1997)	6,958	-3.70	-7.39
Faught and Donoghue (1997)	6,135	-4.30	-5.81	Faught and Donoghue (1997)	7,026	-4.30	-5.81
Fairbridge (1961, 1974)	6,219	-9.00	-4.92	Fairbridge (1961, 1974)	7,089	-9.00	-4.92
Blum *et al.* (2001)	6,345	0.70	-6.69	Fairbridge (1961, 1974)	7,241	-10.10	-6.69
Fairbridge (1961, 1974)	6,360	-10.10	-7.58	Blum *et al.* (2001)	7,263	0.70	-7.58
Faught and Donoghue (1997)	6,375	-0.46	-7.84	Faught and Donoghue (1997)	7,288	-0.46	-7.84
Fairbanks (1989, 1990)	6,400	-19.99	-9.70	Fairbanks (1989, 1990)	7,307	-19.99	-9.70
Fairbridge (1961, 1974)	6,502	-9.90	-10.95	Fairbridge (1961, 1974)	7,383	-9.90	-9.41
Morton *et al.* (2000)	6,510	-6.10	-10.60	Morton et al. (2000)	7,413	-6.10	-10.60
Nelson and Bray (1970)	6,635	-22.02	-11.32	Nelson and Bray (1970)	7,508	-22.02	-11.32
Morton *et al.* (2000)	6,730	-8.10	-9.42	Morton et al. (2000)	7,590	-8.10	-9.42
Faught and Donoghue (1997)	6,755	-7.60	-10.72	Faught and Donoghue (1997)	7,611	-7.60	-9.86
Faught and Donoghue (1997)	6,785	-5.50	-11.70	Faught and Donoghue (1997)	7,613	-5.50	-11.70
Faught and Donoghue (1997)	6,825	-6.70	-9.02	Faught and Donoghue (1997)	7,681	-6.70	-9.81
Fairbridge (1961, 1974)	6,837	-19.00	-9.12	Fairbanks (1989, 1990)	7,689	-13.00	-10.64
Fairbanks (1989, 1990)	6,840	-13.00	-10.02	Fairbridge (1961, 1974)	7,690	-19.00	-10.60
Davies (1980)	6,850	-3.25	-10.28	Blum *et al.* (2001)	7,789	-8.80	-11.07
Blum *et al.* (2001)	6,970	-8.80	-10.58	Morton et al. (2000)	7,808	-13.90	-11.30
Morton *et al.* (2000)	6,980	-13.90	-9.05	Faught and Donoghue (1997)	7,827	-7.30	-10.52
Faught and Donoghue (1997)	7,010	-7.30	-8.27	Blum *et al.* (2001)	7,828	-8.80	-8.72
Blum *et al.* (2001)	7,010	-8.80	-8.72	Morton et al. (2000)	7,835	-8.30	-8.46
Morton *et al.* (2000)	7,020	-8.30	-9.62	Frazier (1974)	7,867	-7.54	-8.63
Frazier (1974)	7,025	-7.54	-8.63	Faught and Donoghue (1997)	7,939	-6.40	-8.20
Faught and Donoghue (1997)	7,130	-6.40	-9.33	Faught and Donoghue (1997)	7,969	-7.00	-8.69
Frazier (1974)	7,150	-15.09	-8.69	Frazier (1974)	7,993	-15.09	-9.66
Faught and Donoghue (1997)	7,160	-7.00	-9.66	Faught and Donoghue (1997)	8,051	-4.30	-9.61
Frazier (1974)	7,240	-12.19	-9.61	Frazier (1974)	8,083	-12.19	-8.81
Faught and Donoghue (1997)	7,240	-4.30	-8.81	Fairbridge (1961, 1974)	8,084	-15.10	-8.51
Fairbridge (1961, 1974)	7,274	-15.10	-7.35	Robbin (1984)	8,090	-7.20	-9.53
Robbin (1984)	7,280	-7.20	-9.53	Davies (1980)	8,205	-0.79	-12.94
Davies (1980)	7,400	-0.79	-11.81	Davies (1980)	8,243	-4.90	-12.23
Davies (1980)	7,450	-4.90	-12.23	Fairbridge (1961, 1974)	8,269	-22.20	-14.31
Fairbridge (1961, 1974)	7,470	-22.20	-14.31	Fairbanks (1989, 1990)	8,341	-28.20	-16.15
Fairbanks (1989, 1990)	7,500	-28.20	-16.15	Robbin (1984)	8,384	-7.20	-19.06
Robbin (1984)	7,595	-7.20	-19.06	Fairbanks (1989, 1990)	8,483	-29.69	-21.36
Fairbanks (1989, 1990)	7,630	-29.69	-21.36	Fairbridge (1961, 1974)	8,560	-20.10	-21.36

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Data younger than ~6,000 yrs BP: combined younger data set.)
(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				**Absolute Age Data Set**			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Fairbridge (1961, 1974)	7,716	-20.10	-21.36	Fairbanks (1989, 1990)	8,655	-21.15	-20.42
Fairbanks (1989, 1990)	7,780	-21.15	-20.42	Fairbridge (1961, 1974)	8,682	-21.00	-20.45
Fairbridge (1961, 1974)	7,814	-21.00	-20.45	Nelson and Bray (1970)	8,715	-22.17	-19.69
Nelson and Bray (1970)	7,840	-22.17	-19.69	Nelson and Bray (1970)	8,850	-21.64	-18.67
Nelson and Bray (1970)	7,975	-21.64	-18.67	Robbin (1984)	8,882	-7.40	-17.35
Robbin (1984)	8,010	-7.40	-17.35	Fairbanks (1989, 1990)	8,891	-24.34	-18.38
Fairbanks (1989, 1990)	8,010	-24.34	-18.38	Fairbridge (1961, 1974)	8,898	-13.00	-17.50
Fairbridge (1961, 1974)	8,012	-13.00	-17.50	Curray (1960)	8,902	-11.89	-18.43
Curray (1960)	8,030	-11.89	-17.29	Fairbanks (1989, 1990)	8,959	-28.20	-20.26
Fairbanks (1989, 1990)	8,080	-28.20	-20.26	Fairbridge (1961, 1974)	9,019	-16.00	-20.81
Fairbridge (1961, 1974)	8,110	-16.00	-20.36	Fairbanks (1989, 1990)	9,041	-28.20	-22.53
Frazier (1974)	8,150	-20.18	-22.53	Frazier (1974)	9,052	-20.18	-24.28
Fairbanks (1989, 1990)	8,160	-28.20	-24.28	Fairbanks (1989, 1990)	9,091	-28.20	-22.39
Fairbanks (1989, 1990)	8,195	-25.07	-22.39	Fairbanks (1989, 1990)	9,094	-25.07	-24.35
Fairbanks (1989, 1990)	8,200	-28.20	-24.35	Morton et al. (2000)	9,214	-24.10	-25.34
Morton *et al.* (2000)	8,250	-24.10	-26.49	Fairbridge (1961, 1974)	9,250	-15.00	-26.29
Fairbridge (1961, 1974)	8,307	-15.00	-25.25	Fairbanks (1989, 1990)	9,260	-29.69	-25.05
Fairbanks (1989, 1990)	8,338	-29.69	-25.49	Frazier (1974)	9,328	-35.17	-24.18
Frazier (1974)	8,400	-35.17	-24.18	Schroeder et al. (1995)	9,407	-26.80	-23.87
Fairbridge (1961, 1974)	8,455	-19.50	-23.87	Fairbridge (1961, 1974)	9,442	-19.50	-26.74
Schroeder *et al*. (1995)	8,480	-26.80	-26.74	Fairbridge (1961, 1974)	9,512	-19.00	-22.96
Fairbridge (1961, 1974)	8,504	-19.00	-25.30	Shepard (1960)	9,547	-21.95	-20.28
Shepard (1960)	8,600	-21.95	-22.63	McBride (1997)	9,584	-35.04	-19.64
McBride (1997)	8,610	-35.04	-23.02	Davies (1980)	9,646	-3.25	-21.59
Nelson and Bray (1970)	8,660	-19.66	-23.94	Curray (1960)	9,659	-16.46	-21.69
Curray (1960)	8,680	-16.46	-25.01	Frazier (1974)	9,685	-22.25	-22.34
Frazier (1974)	8,700	-22.25	-24.80	Fairbanks (1989, 1990)	9,691	-33.19	-20.26
Fairbanks (1989, 1990)	8,700	-33.19	-23.93	Nelson and Bray (1970)	9,728	-19.66	-23.93
Curray (1960)	8,740	-26.52	-23.93	Curray (1960)	9,737	-26.52	-24.39
Morton *et al.* (2000)	8,740	-20.50	-23.89	Morton et al. (2000)	9,737	-20.50	-24.18
Frazier (1974)	8,800	-28.96	-23.68	Frazier (1974)	9,841	-28.96	-23.08
Nelson and Bray (1970)	8,880	-19.66	-22.56	Nelson and Bray (1970)	9,981	-19.66	-25.00
Shepard (1960)	8,950	-16.15	-23.05	Morton et al. (2000)	10,071	-20.80	-27.04
Morton *et al.* (2000)	8,970	-20.80	-23.76	Schroeder et al. (1995)	10,079	-25.45	-27.73
Schroeder *et al*. (1995)	8,980	-25.30	-24.35	Fairbanks (1989, 1990)	10,090	-33.09	-25.90
Fairbridge (1961, 1974)	9,040	-30.00	-27.38	Fairbanks (1989, 1990)	10,118	-40.84	-27.38
Schroeder *et al*. (1995)	9,040	-25.45	-29.21	Schroeder et al. (1995)	10,129	-25.30	-28.55
Fairbanks (1989, 1990)	9,050	-33.09	-28.55	Shepard (1960)	10,143	-16.15	-27.22
Fairbanks (1989, 1990)	9,080	-40.84	-28.20	Fairbridge (1961, 1974)	10,166	-30.00	-26.95
Fairbridge (1961, 1974)	9,136	-29.00	-28.37	Fairbridge (1961, 1974)	10,308	-29.00	-24.38
Frazier (1974)	9,250	-16.15	-27.92	Frazier (1974)	10,388	-16.15	-27.04
Shepard (1960)	9,350	-22.86	-29.69	Schroeder et al. (1995)	10,509	-31.20	-31.22
Schroeder *et al*. (1995)	9,360	-31.20	-30.12	Shepard (1960)	10,514	-22.86	-30.12
Nelson and Bray (1970)	9,370	-22.33	-33.03	Fairbanks (1989, 1990)	10,563	-43.90	-33.03
Shepard (1960)	9,400	-45.42	-35.08	Shepard (1960)	10,572	-45.42	-35.08
Fairbanks (1989, 1990)	9,400	-43.90	-36.13	Nelson and Bray (1970)	10,630	-22.33	-34.94
Curray (1960)	9,460	-49.38	-39.95	Curray (1960)	10,645	-49.38	-39.95
Curray (1960)	9,530	-30.48	-44.82	Curray (1960)	10,716	-30.48	-41.74
Schroeder *et al*. (1995)	9,650	-30.20	-42.25	Schroeder et al. (1995)	10,824	-30.20	-43.52
Fairbanks (1989, 1990)	9,730	-57.92	-44.25	Fairbanks (1989, 1990)	10,978	-57.92	-44.25
Fairbanks (1989, 1990)	9,760	-56.42	-42.91	Fairbanks (1989, 1990)	11,016	-56.42	-42.91
Shepard (1960)	9,800	-27.43	-44.43	Fairbanks (1989, 1990)	11,087	-57.92	-44.43
Fairbanks (1989, 1990)	9,800	-57.92	-43.28	Shepard (1960)	11,093	-27.43	-44.63
Fairbridge (1961, 1974)	9,842	-40.00	-40.23	Fairbridge (1961, 1974)	11,346	-40.00	-40.90
Shepard (1960)	9,950	-41.15	-36.68	Shepard (1960)	11,369	-41.15	-37.38
Schnauble and Goodell (1968)	9,950	-22.10	-37.30	McBride (1997)	11,371	-31.57	-34.33

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Data younger than ~6,000 yrs BP: combined younger data set.)
(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Curray (1960)	10,000	-36.60	-33.57	McBride (1997)	11,382	-31.78	-38.47
McBride (1997)	10,040	-31.57	-35.91	McBride (1997)	11,422	-31.78	-37.76
McBride (1997)	10,040	-31.78	-35.04	Curray (1960)	11,474	-36.60	-35.04
McBride (1997)	10,070	-31.78	-36.43	Fairbanks (1989, 1990)	11,479	-56.42	-35.07
Fairbanks (1989, 1990)	10,100	-56.42	-36.29	Schroeder et al. (1995)	11,491	-35.05	-35.33
Schroeder *et al*. (1995)	10,100	-35.05	-36.57	Schnauble and Goodell (1968)	11,502	-22.10	-39.53
McBride (1997)	10,200	-31.78	-36.53	McBride (1997)	11,681	-31.78	-39.40
Nelson and Bray (1970)	10,207	-35.66	-40.74	Schroeder et al. (1995)	11,889	-33.55	-35.84
Schroeder *et al*. (1995)	10,290	-33.55	-35.81	Fairbanks (1989, 1990)	11,911	-61.21	-33.96
Fairbridge (1961, 1974)	10,293	-31.50	-39.95	Nelson and Bray (1970)	11,919	-35.66	-35.81
Fairbanks (1989, 1990)	10,300	-61.21	-40.42	Fairbridge (1961, 1974)	12,044	-31.50	-40.42
Nelson and Bray (1970)	10,320	-21.95	-41.42	Nelson and Bray (1970)	12,085	-21.95	-43.22
Fairbanks (1989, 1990)	10,500	-63.99	-44.22	Frazier (1974)	12,269	-35.05	-40.57
Frazier (1974)	10,525	-35.05	-45.50	Fairbanks (1989, 1990)	12,299	-63.99	-41.26
Frazier (1974)	10,700	-42.67	-42.54	Frazier (1974)	12,481	-53.19	-46.18
Frazier (1974)	10,700	-53.19	-48.82	Frazier (1974)	12,525	-42.67	-48.82
Schroeder *et al*. (1995)	10,820	-40.45	-49.57	Schroeder et al. (1995)	12,715	-40.45	-53.70
Schroeder *et al*. (1995)	10,860	-40.45	-53.92	Fairbanks (1989, 1990)	12,795	-65.96	-53.92
Fairbanks (1989, 1990)	10,900	-65.96	-60.11	Schroeder et al. (1995)	12,801	-40.45	-58.61
Fairbanks (1989, 1990)	10,900	-69.19	-59.37	Fairbanks (1989, 1990)	12,855	-69.19	-62.93
Frazier (1974)	11,050	-65.53	-64.01	Frazier (1974)	12,933	-65.53	-67.58
Fairbanks (1989, 1990)	11,100	-86.00	-68.65	Fairbanks (1989, 1990)	13,013	-86.00	-65.01
Fairbridge (1961, 1974)	11,363	-48.00	-69.12	Fairbanks (1989, 1990)	13,276	-72.95	-69.12
Fairbanks (1989, 1990)	11,400	-72.95	-65.80	Fairbanks (1989, 1990)	13,326	-72.95	-69.78
Fairbanks (1989, 1990)	11,500	-72.95	-66.99	Fairbridge (1961, 1974)	13,386	-48.00	-70.97
Fairbanks (1989, 1990)	11,640	-69.19	-65.26	Fairbanks (1989, 1990)	13,499	-69.19	-71.91
Fairbridge (1961, 1974)	11,660	-46.00	-71.63	Fairbanks (1989, 1990)	13,592	-73.85	-71.98
Fairbanks (1989, 1990)	11,720	-73.85	-71.69	Fairbanks (1989, 1990)	13,637	-73.85	-68.13
Fairbanks (1989, 1990)	11,800	-73.85	-69.24	Fairbanks (1989, 1990)	13,664	-92.61	-71.24
Fairbanks (1989, 1990)	11,800	-92.61	-69.33	Fairbanks (1989, 1990)	13,677	-73.41	-69.33
Fairbanks (1989, 1990)	11,850	-73.41	-70.04	Fairbridge (1961, 1974)	13,703	-46.00	-72.79
Curray (1960)	11,900	-55.78	-73.50	Frazier (1974)	13,816	-69.80	-69.52
Frazier (1974)	11,900	-69.80	-76.76	Curray (1960)	13,845	-55.78	-70.10
Fairbridge (1961, 1974)	11,941	-51.00	-76.91	Fairbanks (1989, 1990)	13,928	-98.06	-73.00
Fairbanks (1989, 1990)	12,000	-98.06	-79.99	Fairbridge (1961, 1974)	14,044	-51.00	-79.99
Fairbanks (1989, 1990)	12,200	-96.64	-85.41	Fairbanks (1989, 1990)	14,134	-96.64	-83.41
Fairbanks (1989, 1990)	12,250	-93.71	-89.27	Fairbanks (1989, 1990)	14,214	-93.71	-89.27
Fairbanks (1989, 1990)	12,250	-94.96	-95.99	Fairbanks (1989, 1990)	14,214	-94.96	-89.27
Fairbanks (1989, 1990)	12,300	-93.69	-92.17	Fairbanks (1989, 1990)	14,308	-93.69	-92.17
Fairbanks (1989, 1990)	12,300	-96.80	-93.63	Fairbanks (1989, 1990)	14,308	-96.80	-93.63
Fairbanks (1989, 1990)	12,500	-98.06	-96.08	Fairbanks (1989, 1990)	14,733	-98.06	-96.08
Curray (1960)	12,900	-71.32	-98.40	Curray (1960)	15,174	-71.32	-98.40
Fairbanks (1989, 1990)	14,280	-106.90	-101.07	Fairbanks (1989, 1990)	16,992	-106.90	-101.07
Fairbanks (1989, 1990)	14,340	-110.83	-103.12	Fairbanks (1989, 1990)	17,061	-110.83	-103.12
Fairbanks (1989, 1990)	14,700	-111.19	-105.44	Fairbanks (1989, 1990)	17,476	-111.19	-105.44
Fairbanks (1989, 1990)	14,815	-112.36	-112.27	Fairbanks (1989, 1990)	17,609	-112.36	-112.27
Fairbanks (1989, 1990)	14,930	-111.19	-112.88	Fairbanks (1989, 1990)	17,741	-111.19	-112.88
Fairbanks (1989, 1990)	15,100	-114.28	-113.42	Fairbanks (1989, 1990)	17,937	-114.28	-113.42
Fairbanks (1989, 1990)	15,200	-119.13	-112.75	Fairbanks (1989, 1990)	18,053	-119.13	-112.75
Fairbanks (1989, 1990)	15,390	-111.19	-112.18	Fairbanks (1989, 1990)	18,271	-111.19	-112.18
Fairbanks (1989, 1990)	15,400	-114.60	-113.31	Fairbanks (1989, 1990)	18,283	-114.60	-113.31
Frazier (1974)	15,575	-106.47	-113.36	Frazier (1974)	18,483	-106.47	-113.36
Fairbanks (1989, 1990)	15,630	-108.40	-113.41	Fairbanks (1989, 1990)	18,548	-108.40	-113.41
Fairbanks (1989, 1990)	15,851	-119.13	-114.59	Fairbanks (1989, 1990)	18,801	-119.13	-114.59
Fairbanks (1989, 1990)	16,020	-114.60	-112.63	Fairbanks (1989, 1990)	18,996	-114.60	-112.63
Fairbanks (1989, 1990)	16,145	-119.48	-115.34	Fairbanks (1989, 1990)	19,139	-119.48	-115.34

GULF OF MEXICO TOTAL DATA SET: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Data younger than ~6,000 yrs BP: combined younger data set.)
(Data older than ~6,000 yrs BP: older data set.)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Fairbanks (1989, 1990)	16,260	-119.48	-116.92	Fairbanks (1989, 1990)	19,271	-119.48	-116.92
Frazier (1974)	16,600	-100.86	-118.56	Frazier (1974)	19,661	-100.86	-118.56
Fairbanks (1989, 1990)	16,700	-125.44	-119.00	Fairbanks (1989, 1990)	19,776	-125.44	-119.00
Fairbanks (1989, 1990)	17,085	-119.48	-121.00	Fairbanks (1989, 1990)	20,218	-119.48	-121.00
Fairbanks (1989, 1990)	18,200	-130.57	-125.00	Fairbanks (1989, 1990)	22,080	-130.57	-125.00

[1] Data of Stapor *et al.* , (1977); Tanner *et al* . (1989); Tanner (1991a, 1992a, 1993).

APPENDIX III

Gulf of Mexico Younger Data Set A: 7-Point Floating Average Sea-Level Curve

GULF OF MEXICO YOUNGER DATA SET A: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Sea level indicators seaward of current sea level)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
	0	0.00	0		0	0.00	0
Davies (1980)	285	-0.71	-0.71	Davies (1980)	332	-0.71	-0.71
Robbin (1984)	360	0.00	0.00	Shier (1969)	393	-0.08	-0.08
Shier (1969)	380	-0.08	-1.27	Robbin (1984)	405	0.00	-1.27
Frazier (1974)	900	-0.73	-1.65	Frazier (1974)	838	-0.73	-1.65
Davies (1980)	1,015	-3.94	-2.09	Davies (1980)	926	-3.94	-2.09
Davies (1980)	1,065	-3.42	-2.15	Davies (1980)	987	-3.42	-2.15
Davies (1980)	1,230	-2.67	-2.22	Davies (1980)	1,147	-2.67	-2.22
Frazier (1974)	1,400	-3.76	-2.63	Frazier (1974)	1,368	-3.76	-2.25
Scholl and Stuiver (1967)	1,698	-0.48	-2.21	Robbin (1984)	1,652	-0.50	-2.21
Robbin (1984)	1,740	-0.50	-1.92	Scholl and Stuiver (1967)	1,674	-0.48	-1.92
Shepard (1960)	2,050	-3.66	-1.75	Robbin (1984)	2,068	-1.00	-1.75
Robbin (1984)	2,090	-1.00	-1.35	Shepard (1960)	2,086	-3.66	-1.36
Shier (1969)	2,285	-1.35	-1.43	Shier (1969)	2,382	-1.35	-1.42
Robbin (1984)	2,460	-1.50	-1.70	Robbin (1984)	2,541	-1.50	-1.75
Scholl and Stuiver (1967)	2,466	-0.97	-1.30	Robbin (1984)	2,579	-1.00	-1.82
Robbin (1984)	2,530	-1.00	-1.55	Scholl and Stuiver (1967)	2,581	-0.97	-1.64
Frazier (1974)	2,550	-2.44	-1.57	Davies (1980)	2,616	-2.74	-1.57
Scholl and Stuiver (1967)	2,565	-0.82	-1.57	Robbin (1984)	2,626	-1.50	-1.57
Davies (1980)	2,575	-2.74	-1.65	Frazier (1974)	2,691	-2.44	-1.64
Robbin (1984)	2,580	-1.50	-1.90	Scholl and Stuiver (1967)	2,763	-0.82	-1.90
Robbin (1984)	2,650	-1.50	-1.79	Robbin (1984)	2,765	-1.50	-1.79
Scholl and Stuiver (1967)	2,724	-1.53	-1.96	Scholl and Stuiver (1967)	2,911	-1.53	-1.82
Kuehn (1980)	2,775	-2.74	-1.74	Kuehn (1980)	2,916	-2.74	-1.64
Spackman et al. (1966)	2,830	-1.71	-1.70	Robbin (1984)	2,967	-2.00	-1.70
Robbin (1984)	2,850	-2.00	-1.69	Spackman et al. (1966)	3,039	-1.71	-1.69
Scholl and Stuiver (1967)	2,894	-1.19	-1.89	Scholl and Stuiver (1967)	3,053	-1.19	-1.89
Scholl and Stuiver (1967)	2,905	-1.21	-1.85	Scholl and Stuiver (1967)	3,127	-1.21	-1.85
Scholl and Stuiver (1967)	2,985	-1.46	-1.74	Scholl and Stuiver (1967)	3,215	-1.46	-1.70
Davies (1980)	3,155	-2.90	-2.01	Davies (1980)	3,369	-2.90	-2.01
Robbin (1984)	3,170	-2.50	-2.05	Robbin (1984)	3,392	-2.50	-2.23
Shepard (1960)	3,200	-0.91	-2.27	Shepard (1960)	3,486	-0.91	-2.27
Kuehn (1980)	3,260	-3.91	-2.19	Kuehn (1980)	3,490	-3.91	-2.19
Scholl and Stuiver (1967)	3,344	-1.49	-2.00	Kuehn (1980)	3,649	-2.74	-2.00
Kuehn (1980)	3,399	-2.74	-2.82	Scholl and Stuiver (1967)	3,674	-1.49	-2.82
Scholl and Stuiver (1967)	3,408	-0.91	-2.93	Scholl and Stuiver (1967)	3,685	-0.91	-2.93
Nelson and Bray (1970)	3,475	-1.52	-2.77	Nelson and Bray (1970)	3,745	-1.52	-2.78
Frazier (1974)	3,500	-8.23	-2.96	Frazier (1974)	3,859	-8.23	-2.81
Scholl and Stuiver (1967)	3,650	-1.70	-3.00	Scholl and Stuiver (1967)	3,978	-1.70	-3.00
Frazier (1974)	3,650	-2.77	-3.42	Kuehn (1980)	3,986	-2.83	-3.42
Kuehn (1980)	3,660	-2.83	-3.47	Robbin (1984)	4,050	-3.00	-3.47
Robbin (1984)	3,710	-3.00	-2.82	Frazier (1974)	4,060	-2.77	-2.82
Shier (1969)	3,800	-3.85	-3.07	Shier (1969)	4,261	-3.85	-3.07
Scholl and Stuiver (1967)	3,930	-1.92	-2.96	Scholl and Stuiver (1967)	4,365	-1.92	-2.95
Davies (1980)	3,965	-3.63	-2.82	Davies (1980)	4,417	-3.63	-2.79
Robbin (1984)	3,970	-3.50	-2.73	Robbin (1984)	4,425	-3.50	-2.73
Robbin (1984)	3,980	-2.00	-2.51	Robbin (1984)	4,440	-2.00	-2.51
Scholl and Stuiver (1967)	4,000	-1.86	-2.81	Scholl and Stuiver (1967)	4,473	-1.86	-2.81
Davies (1980)	4,015	-2.34	-2.87	Kuehn (1980)	4,495	-2.32	-2.87
Kuehn (1980)	4,015	-2.32	-2.72	Davies (1980)	4,497	-2.34	-2.72
Robbin (1984)	4,050	-4.00	-2.83	Robbin (1984)	4,550	-4.00	-2.83
Spackman et al. (1966)	4,080	-4.04	-3.21	Spackman et al. (1966)	4,574	-4.04	-3.21
Robbin (1984)	4,080	-2.50	-3.29	Robbin (1984)	4,595	-2.50	-3.29
Kuehn (1980)	4,095	-2.77	-3.64	Kuehn (1980)	4,615	-2.77	-3.64
Robbin (1984)	4,150	-4.50	-3.19	Robbin (1984)	4,662	-4.50	-3.19
Robbin (1984)	4,160	-2.90	-2.86	Robbin (1984)	4,673	-2.90	-2.86

GULF OF MEXICO YOUNGER DATA SET A: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Sea level indicators seaward of current sea level)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Robbin (1984)	4,220	-4.80	-2.94	Robbin (1984)	4,728	-4.80	-2.94
Davies (1980)	4,310	-0.79	-2.64	Davies (1980)	4,897	-0.79	-2.64
Kuehn (1980)	4,420	-1.77	-2.06	Kuehn (1980)	5,048	-1.77	-2.06
Frazier (1974)	4,600	-3.05	-2.63	Frazier (1974)	5,316	-3.05	-2.35
Davies (1980)	4,695	-0.70	-2.64	Davies (1980)	5,417	-0.70	-2.64
Davies (1980)	4,770	-0.44	-2.92	Davies (1980)	5,494	-0.44	-2.92
Frazier (1974)	4,800	-6.86	-3.11	Robbin (1984)	5,519	-4.90	-3.11
Robbin (1984)	4,800	-4.90	-3.13	Frazier (1974)	5,542	-6.86	-3.13
Shepard (1960)	4,900	-2.74	-3.28	Shepard (1960)	5,611	-2.74	-3.28
Nelson and Bray (1970)	4,900	-3.05	-3.71	Nelson and Bray (1970)	5,646	-3.05	-3.71
Smith (1969)	4,950	-3.20	-3.56	Smith (1969)	5,710	-3.20	-3.84
Faught & Donoghue (1997)	5,140	-1.80	-3.16	Faught and Donoghue (1997)	5,882	-1.80	-3.16
Davies (1980)	5,190	-3.45	-3.85	Davies (1980)	5,952	-3.45	-3.86
Shepard (1960)	5,200	-5.79	-4.03	Shepard (1960)	5,969	-5.79	-4.03
Kuehn (1980)	5,370	-2.10	-4.57	Kuehn (1980)	6,136	-2.10	-4.58
McBride (1997)	5,450	-7.56	-4.84	McBride (1997)	6,248	-7.60	-5.06
Robbin (1984)	5,550	-4.30	-5.09	Robbin (1984)	6,340	-4.30	-5.35
Frazier (1974)	5,600	-7.01	-5.04	Frazier (1974)	6,412	-7.01	-6.01
Shepard (1960)	5,600	-3.66	-6.23	Nelson and Bray (1970)	6,450	-5.18	-6.67
Nelson and Bray (1970)	5,650	-5.18	-6.10	Frazier (1974)	6,465	-5.47	-6.67
Frazier (1974)	5,650	-5.47	-6.57	Fairbanks (1989, 1990)	6,550	-10.40	-6.58
Fairbanks (1989, 1990)	5,735	-10.40	-6.10	Robbin (1984)	6,903	-6.70	-6.19
Robbin (1984)	6,060	-6.70	-6.19	McBride (1997)	6,944	-7.60	-6.11
McBride (1997)	6,070	-7.56	-6.10	Faught and Donoghue (1997)	6,958	-3.70	-8.18
Faught and Donoghue (1997)	6,100	-3.70	-8.18	Faught and Donoghue (1997)	7,026	-4.30	-9.87
Faught and Donoghue (1997)	6,135	-4.30	-9.86	Faught and Donoghue (1997)	7,288	-4.60	-10.00
Faught and Donoghue (1997)	6,375	-4.60	-9.99	Fairbanks (1989, 1990)	7,307	-19.99	-9.70
Fairbanks (1989, 1990)	6,400	-19.99	-9.70	Nelson and Bray (1970)	7,508	-22.20	-10.13
Nelson and Bray (1970)	6,635	-22.20	-10.13	Faught and Donoghue (1997)	7,611	-7.60	-11.37
Faught and Donoghue (1997)	6,755	-7.60	-11.37	Faught and Donoghue (1997)	7,613	-5.50	-11.76
Faught and Donoghue (1997)	6,785	-5.50	-11.18	Faught and Donoghue (1997)	7,681	-6.70	-9.98
Faught and Donoghue (1997)	6,825	-6.70	-9.36	Fairbanks (1989, 1990)	7,689	-13.00	-7.72
Fairbanks (1989, 1990)	6,840	-13.00	-7.27	Faught and Donoghue (1997)	7,827	-7.30	-7.63
Davies (1980)	6,850	-3.25	-7.10	Frazier (1974)	7,867	-7.54	-9.00
Faught and Donoghue (1997)	7,010	-7.30	-8.47	Faught and Donoghue (1997)	7,939	-6.40	-9.39
Frazier (1974)	7,025	-7.54	-8.51	Faught and Donoghue (1997)	7,969	-7.00	-8.67
Faught & Donoghue (1997)	7,130	-6.40	-8.40	Frazier (1974)	7,993	-15.09	-9.01
Frazier (1974)	7,150	-15.09	-8.55				
Faught & Donoghue (1997)	7,160	-7.00	-8.53				
Frazier (1974)	7,240	-12.19	-7.57				
Faught & Donoghue (1997)	7,240	-4.30	-7.35				
Robbin (1984)	7,280	-7.2	-9.23				
Davies (1980)	7,400	-0.79	-9.25				
Davies (1980)	7,450	-4.90	-11.75				
Fairbanks (1989, 1990)	7,500	-28.20	-14.16				
Robbin (1984)	7,595	-7.2	-16.30				
Fairbanks (1989, 1990)	7,630	-29.69	-18.89				
Fairbanks (1989, 1990)	7,780	-21.15	-21.68				
Nelson and Bray (1970)	7,840	-22.17	-20.05				

APPENDIX IV

Gulf of Mexico Younger Data Set B: 7-Point Floating Average Sea-Level Curve

GULF OF MEXICO YOUNGER DATA SET B: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE
(Sea level indicators landward of current sea level)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Fairbridge (1961, 1974)	0	0.00	0.00	Fairbridge (1961, 1974)	0	0.00	0.00
St. Vincent Island, FL[1]	0	-0.15	-0.15	St. Vincent Island, FL[1]	0	0.00	0.00
Stapor and Stone (2004)	186	-0.50	-0.29	Stapor and Stone (2004)	300	-0.50	0.00
Morton et al. (2000)	290	-1.50	-0.33	Morton et al. (2000)	375	-1.50	-0.31
Schnable and Goodell (1968)	350	0.00	-0.29	Schnable and Goodell (1968)	377	0.00	-0.26
Fairbridge (1961, 1974)	364	0.00	-0.26	Fairbridge (1961, 1974)	439	0.00	-0.26
St. Vincent Island, FL[1]	405	-0.15	-0.30	St. Vincent Island	450	-0.15	-0.30
McFarlan (1961)	520	0.30	-0.03	McFarlan (1961)	517	0.30	-0.03
Schnable and Goodell (1968)	560	0.00	-0.01	Schnable and Goodell (1968)	569	0.00	-0.03
Fairbridge (1961, 1974)	691	-0.75	-0.01	Fairbridge (1961, 1974)	657	-0.75	-0.01
Stapor and Stone (2004)	725	0.40	0.01	Stapor and Stone (2004)	700	0.40	0.01
St. Vincent Island, FL[1]	841	0.10	-0.16	Fairbridge (1961, 1974)	780	0.00	-0.16
Fairbridge (1961, 1974)	876	0.00	0.00	St. Vincent Island, FL[1]	800	0.10	0.00
Stapor and Stone (2004)	1,083	0.00	0.02	Stapor and Stone (2004)	1,000	0.00	-0.01
Fairbridge (1961, 1974)	1,109	-0.85	-0.01	Fairbridge (1961, 1974)	1,011	-0.85	-0.16
Morton et al. (2000)	1,220	1.10	-0.15	Morton et al. (2000)	1,142	1.10	-0.14
McFarlan (1961)	1,220	-0.60	-0.44	Stapor and Stone (2004)	1,150	-0.85	-0.44
McFarlan (1961)	1,250	0.15	-0.39	McFarlan (1961)	1,155	-0.61	-0.39
Stapor and Stone (2004)	1,250	-0.85	-0.25	McFarlan (1961)	1,184	0.15	-0.25
St. Vincent Island, FL[1]	1,342	-2.00	-0.45	St. Vincent Island, FL[1]	1,250	-2.00	-0.45
McFarlan (1961)	1,350	0.30	-0.39	McFarlan (1961)	1,290	0.30	-0.35
Schnable and Goodell (1968)	1,390	0.15	-0.45	Schnable and Goodell (1968)	1,298	0.15	-0.39
Schnable and Goodell (1968)	1,400	-0.30	-0.35	Schnable and Goodell (1968)	1,311	-0.30	-0.44
Schnable and Goodell (1968)	1,400	-0.15	-0.19	Schnable and Goodell (1968)	1,311	-0.15	-0.19
McFarlan (1961)	1,450	-0.30	-0.10	Stapor and Stone (2004)	1,370	-0.90	-0.10
Schnable and Goodell (1968)	1,475	-0.15	-0.12	Schnable and Goodell (1968)	1,385	-0.15	-0.12
Stapor and Stone (2004)	1,481	-0.90	-0.21	McFarlan (1961)	1,394	-0.30	0.06
Fairbridge (1961, 1974)	1,538	0.95	-0.14	Fairbridge (1961, 1974)	1,432	0.95	0.13
Stapor and Stone (2004)	1,581	0.00	-0.19	Stapor and Stone (2004)	1,470	0.00	0.17
McFarlan (1961)	1,600	-0.91	-0.02	Stapor and Stone (2004)	1,500	1.00	0.06
McFarlan (1961)	1,600	0.30	0.33	McFarlan (1961)	1,552	0.30	0.33
McFarlan (1961)	1,600	-0.61	0.18	McFarlan (1961)	1,552	-0.61	0.18
Stapor and Stone (2004)	1,611	1.00	0.58	McFarlan (1961)	1,554	-0.91	0.58
Stapor and Stone (2004)	1,708	1.60	0.68	Stapor and Stone (2004)	1,600	1.60	0.58
Fairbridge (1961, 1974)	1,737	-0.15	0.78	Fairbridge (1961, 1974)	1,647	-0.15	0.68
Morton et al. (2000)	1,740	2.80	1.01	Morton et al. (2000)	1,652	2.80	0.74
Fairbridge (1961, 1974)	1,833	-0.15	1.20	St. Vincent Island, FL[1]	1,750	1.00	1.20
St. Vincent Island, FL[1]	1,835	1.00	1.34	Stapor and Stone (2004)	1,750	1.00	0.97
Stapor and Stone (2004)	1,848	1.00	1.74	Fairbridge (1961, 1974)	1,765	-0.15	1.36
Morton et al. (2000)	1,860	2.30	1.34	Morton et al. (2000)	1,790	2.30	1.34
Behrens (1966)	1,930	2.60	1.23	Stapor and Stone (2004)	1,900	0.00	1.06
Behrens (1966)	1,940	2.60	0.94	Behrens (1966)	1,936	2.60	0.78
Stapor and Stone (2004)	1,984	0.00	0.80	Behrens (1966)	1,947	2.60	0.80
Fairbridge (1961, 1974)	2,019	-0.90	0.37	Fairbridge (1961, 1974)	1,974	-0.90	0.37
Stapor and Stone (2004)	2,072	-1.00	-0.11	Stapor and Stone (2004)	2,000	-1.00	0.26
Fairbridge (1961, 1974)	2,154	0.00	-0.08	Fairbridge (1961, 1974)	2,148	0.00	0.29
Fairbridge (1961, 1974)	2,286	-0.70	0.29	Fairbridge (1961, 1974)	2,264	-0.70	0.29
St. Vincent Island, FL[1]	2,320	-0.75	0.21	St. Vincent Island, FL[1]	2,300	-0.75	0.21
Morton et al. (2000)	2,340	2.80	0.18	Morton et al. (2000)	2,368	2.80	0.49
Behrens (1966)	2,340	2.60	0.32	Behrens (1966)	2,457	2.60	0.54
Stapor and Stone (2004)	2,488	-1.50	0.46	Stapor and Stone (2004)	2,500	-1.50	0.46
McFarlan (1961)	2,520	-1.22	0.57	Fairbridge (1961, 1974)	2,584	1.00	0.57
Fairbridge (1961, 1974)	2,539	1.00	0.27	St. Vincent Island, FL[1]	2,600	0.30	0.27
St. Vincent Island, FL[1]	2,566	0.30	-0.06	McFarlan (1961)	2,646	-1.22	-0.32
Fairbridge (1961, 1974)	2,622	0.00	0.22	Fairbridge (1961, 1974)	2,735	0.00	-0.06
Fairbridge (1961, 1974)	2,703	0.70	0.18	Fairbridge (1961, 1974)	2,823	0.70	-0.14

GULF OF MEXICO YOUNGER DATA SET B: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE (Sea level indicators landward of current sea level)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
McFarlan (1961)	2,750	0.30	-0.18	St. Vincent Island	2,900	-1.50	-0.39
McFarlan (1961)	2,775	0.46	-0.48	McFarlan (1961)	2,941	0.30	-0.48
St. Vincent Island, FL[1]	2,802	-1.50	-0.61	McFarlan (1961)	2,969	0.46	-0.61
Stapor and Stone (2004)	2,876	-1.50	-0.69	Stapor and Stone (2004)	3,000	-1.50	-0.69
Fairbridge (1961, 1974)	2,903	-1.80	-0.91	Fairbridge (1961, 1974)	3,049	-1.80	-0.65
Fairbridge (1961, 1974)	3,100	-0.95	-1.19	Fairbridge (1961, 1974)	3,297	-0.95	-0.91
McFarlan (1961)	3,150	0.15	-1.17	McFarlan (1961)	3,426	0.15	-1.17
Morton et al. (2000)	3,220	-1.20	-1.14	Morton et al. (2000)	3,445	-1.20	-1.14
Stapor and Stone (2004)	3,252	-1.50	-1.10	Stapor and Stone (2004)	3,500	-1.50	-0.60
Fairbridge (1961, 1974)	3,333	-1.40	-0.68	Fairbridge (1961, 1974)	3,571	-1.40	-0.68
Stapor and Stone (2004)	3,440	-1.30	-0.59	Stapor and Stone (2004)	3,750	-1.30	-0.59
St. Vincent Island, FL[1]	3,482	-1.50	-1.16	Fairbridge (1961, 1974)	3,760	2.00	-1.16
Fairbridge (1961, 1974)	3,488	2.00	-0.94	St. Vincent Island, FL[1]	3,800	-1.50	-0.80
Morton et al. (2000)	3,550	0.80	-0.60	Morton et al. (2000)	3,837	0.80	-0.93
Morton et al. (2000)	3,580	-5.20	-0.74	Morton et al. (2000)	3,876	-5.20	-0.74
Stapor and Stone (2004)	3,591	0.00	-0.19	Fairbridge (1961, 1974)	3,913	1.00	-0.69
Fairbridge (1961, 1974)	3,604	1.00	-0.84	Morton et al. (2000)	3,943	-2.30	-0.84
Morton et al. (2000)	3,630	-2.30	-0.74	Stapor and Stone (2004)	3,950	0.00	-0.74
Fairbridge (1961, 1974)	3,720	2.40	0.25	Fairbridge (1961, 1974)	4,073	2.40	0.22
Morton et al. (2000)	3,760	-2.60	0.46	Morton et al. (2000)	4,124	-2.60	0.32
Schnable and Goodell (1968)	3,780	1.52	0.57	Schnable and Goodell (1968)	4,173	1.52	0.90
Stapor and Stone (2004)	3,781	1.70	0.62	St. Vincent Island, FL[1]	4,200	1.50	0.62
St. Vincent Island, FL[1]	3,781	1.50	-0.01	Stapor and Stone (2004)	4,200	1.70	-0.01
Stapor and Stone (2004)	4,013	1.80	-0.42	Stapor and Stone (2004)	4,500	1.80	-0.42
Morton et al. (2000)	4,030	-2.00	-0.93	Morton et al. (2000)	4,519	-2.00	-0.93
Fairbridge (1961, 1974)	4,033	-2.00	-1.60	Fairbridge (1961, 1974)	4,522	-2.00	-1.57
Schnable and Goodell (1968)	4,100	-5.49	-1.84	Schnable and Goodell (1968)	4,614	-5.49	-1.84
Fairbridge (1961, 1974)	4,112	-2.00	-2.64	Fairbridge (1961, 1974)	4,624	-2.00	-2.64
Fairbridge (1961, 1974)	4,271	-3.00	-2.96	Fairbridge (1961, 1974)	4,830	-3.00	-2.96
Morton et al. (2000)	4,280	-0.20	-2.41	Morton et al. (2000)	4,846	-0.20	-2.41
Schnable and Goodell (1968)	4,370	-3.81	-1.44	Schnable and Goodell (1968)	4,943	-3.81	-1.44
Morton et al. (2000)	4,390	-4.20	-0.94	Morton et al. (2000)	4,986	-4.20	-1.14
Stapor and Stone (2004)	4,412	1.80	-0.49	Stapor and Stone (2004)	5,000	1.80	-0.49
Fairbridge (1961, 1974)	4,513	1.30	-0.29	Fairbridge (1961, 1974)	5,157	1.30	-0.32
Blum et al. (2001)	4,560	1.50	0.39	Schnable and Goodell (1968)	5,201	0.15	0.39
Schnable and Goodell (1968)	4,610	0.15	1.31	Blum et al. (2001)	5,271	1.50	1.31
Blum et al. (2001)	4,656	1.20	0.04	Fairbridge (1961, 1974)	5,475	1.00	0.04
Fairbridge (1961, 1974)	4,760	1.00	-0.19	Blum et al. (2001)	5,499	1.20	-0.19
Fairbridge (1961, 1974)	4,844	2.20	-0.19	Fairbridge (1961, 1974)	5,574	2.20	0.00
Morton et al. (2000)	4,910	-7.10	0.01	Morton et al. (2000)	5,647	-7.1	0.01
Morton et al. (2000)	5,050	-0.30	-0.16	Morton et al. (2000)	5,794	-0.3	-0.13
St. Vincent Island, FL[1]	5,054	1.50	-1.24	St. Vincent Island, FL[1]	5,800	1.50	-1.24
Blum et al. (2001)	5,125	1.60	-1.31	Blum et al. (2001)	5,890	1.60	-1.31
Fairbridge (1961, 1974)	5,141	0.00	0.01	Fairbridge (1961, 1974)	5,895	0.00	0.01
Morton et al. (2000)	5,200	-6.60	-0.04	Morton et al. (2000)	5,965	-6.6	-0.04
Blum et al. (2001)	5,285	1.70	-1.03	Blum et al. (2001)	6,070	1.7	-1.03
Fairbridge (1961, 1974)	5,315	2.20	-1.94	Fairbridge (1961, 1974)	6,086	2.20	-1.94
Morton et al. (2000)	5,340	-0.70	-1.73	Morton et al. (2000)	6,111	-0.7	-1.73
Fairbridge (1961, 1974)	5,624	-5.40	-2.48	Fairbridge (1961, 1974)	6,423	-5.40	-2.48
Fairbridge (1961, 1974)	5,714	-4.80	-4.21	Fairbridge (1961, 1974)	6,520	-4.80	-4.21
Blum et al. (2001)	5,870	1.50	-5.81	Blum et al. (2001)	6,633	1.50	-5.81
Fairbridge (1961, 1974)	5,988	-11.85	-5.61	Fairbridge (1961, 1974)	6,838	-11.85	-7.15
Morton et al. (2000)	6,030	-10.40	-6.28	Morton et al. (2000)	6,868	-10.4	-6.28
Fairbridge (1961, 1974)	6,219	-9.00	-7.01	Fairbridge (1961, 1974)	7,089	-9.00	-7.01
Blum et al. (2001)	6,345	0.70	-8.09	Fairbridge (1961, 1974)	7,241	-10.10	-8.09
Fairbridge (1961, 1974)	6,360	-10.10	-7.56	Blum et al. (2001)	7,263	0.70	-7.56

GULF OF MEXICO YOUNGER DATA SET B: 7-POINT FLOATING AVERAGE SEA LEVEL CURVE (Sea level indicators landward of current sea level)

^{14}C Age Data Set				Absolute Age Data Set			
Investigators	^{14}C Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)	Investigators	Absolute Age (yrs BP)	Depth Relative to Current MSL (m MSL)	7-Point Floating Average Depth (m MSL)
Fairbridge (1961, 1974)	6,502	-9.90	-8.79	Fairbridge (1961, 1974)	7,383	-9.90	-8.79
Morton et al. (2000)	6,510	-6.10	-8.76	Morton et al. (2000)	7,413	-6.1	-8.76
Morton et al. (2000)	6,730	-8.10	-10.84	Morton et al. (2000)	7,590	-8.1	-9.30
Fairbridge (1961, 1974)	6,837	-19.00	-10.66	Fairbridge (1961, 1974)	7,690	-19.00	-10.66
Blum et al. (2001)	6,970	-8.80	-10.43	Blum et al. (2001)	7,789	-8.80	-10.43
Morton et al. (2000)	6,980	-13.90	-11.71	Morton et al. (2000)	7,808	-13.9	-11.71
Blum et al. (2001)	7,010	-8.80	-13.73	Blum et al. (2001)	7,828	-8.8	-12.54
Morton et al. (2000)	7,020	-8.3	-13.89	Morton et al. (2000)	7,835	-8.3	-11.09
Fairbridge (1961, 1974)	7,274	-15.10	-15.63	Fairbridge (1961, 1974)	8,084	-15.10	-11.01
Fairbridge (1961, 1974)	7,470	-22.20	-17.09	Morton et al. (2000)	7,808	-13.9	-11.19
Fairbridge (1961, 1974)	7,716	-20.10	-18.47	Blum et al. (2001)	7,828	-8.8	-11.58
Fairbridge (1961, 1974)	7,814	-21.00	-20.50	Morton et al. (2000)	7,835	-8.3	-12.24
Morton et al. (2000)	8,250	-24.1	-21.85	Fairbridge (1961, 1974)	8,084	-15.10	-11.53

[1] Data of Stapor *et al*., (1977); Tanner *et al*., (1989), Tanner (1991a, 1992a, 1993).

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