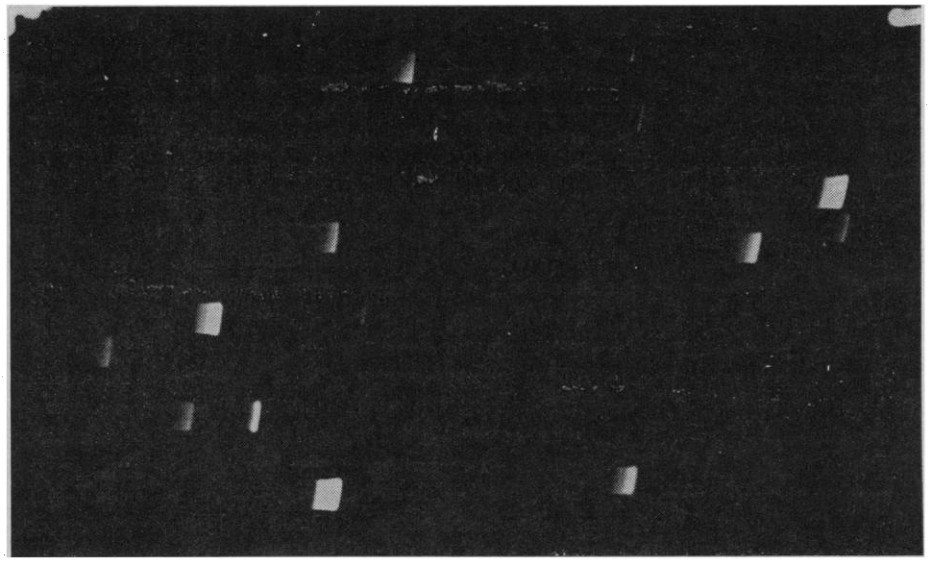

Fig. 2. Prismatic spectra of stars near Antares. In this figure, north is to the left and east is down. The break near the right edge of the spectra is due to the hydrogen Balmer discontinuity. The break near the center of several spectra is due to an instrumental effect. The overexposed image of τ Scorpii appears to the left of center at the bottom, with Antares immediately above and to the left.

and it is expected that energy curves can be derived for about 50 stars. These data will be supplemented by energy curves currently being measured for 20 stars observed during the Gemini 10 flight (*3*). This work partially overlaps and partially extends previous ultraviolet-energy distribution measures (*4*).

The prism spectra (Fig. 2) show two spectral features despite their very low dispersion. The Balmer discontinuity of hydrogen is very prominent in A stars, and in F stars the metal multiplets seen in the grating spectrum of Canopus blend into two broad absorption features visible in the 2400 to 2800 Å region. The spread in the correlation between these features and conventional spectral types has not yet been established. An emission line is visible in the prism spectrum of the Wolf-Rayet star HD 156385 (spectral class WC7p). This is tentatively identified as the 2297 Å line of C III due to the $2p^2\ {}^1D$-$2p^1P^0$ transition.

The spectra were obtained with the quartz–lithium fluoride Barnes lens (73-mm, focal length $f/3.3$) of the general-purpose Maurer camera, designed especially for use by the Gemini astronauts. The image diameter produced by the camera is 50 μ or less, over a field diameter of 30° and a wavelength range from 2100 to 3000 Å. The transparency cutoff of the lens is at about 2100 Å.

The observations were carried out with the right-hand hatch open and with the spacecraft docked to the Agena. The camera was attached to the spacecraft frame by a bracket which positioned the field center 5° above the roll axis of the spacecraft. To operate the camera, Gordon stood up in the open hatch while Conrad remained in his seat to control the pointing of the spacecraft and to time the length of exposures. Each field was visually located by the astronauts, and the Gemini attitude control system was used to point the spacecraft at the region. The Agena's automatic stabilizing system was then activated, and Gordon proceeded to take six exposures on each field with lengths ranging from 20 seconds to 2 minutes.

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5. We thank many persons in NASA for assistance in the conduct of this program. Chief among these are the Gemini 11 flight crew, Commanders C. Conrad and R. Gordon; C. Kotila, technical monitor for this experiment; and R. Stokes, who supervised the development of the Maurer camera.

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Signs Test Applied to Caribbean Deep-Sea Core A 172-6

Abstract. *Caribbean core A 172-6 of the Lamont Geological Observatory series has been subjected to a nonparametric test for trend in order to examine the distribution of selected elements and of published paleotemperature data throughout a core length of 9.35 meters. First appearance of trend below top of core has been calculated, and the results of these tests are discussed.*

Core A 172-6 of the Lamont Geological Observatory series was spectrochemically analyzed for selected major and minor elements and the data thus obtained were compared in a study by Yalkovsky (*1*) with published paleotemperature data [Emiliani (*2*)] at correlative sampling intervals of 10-cm spacing throughout a core length of 9.35 m. The elements considered (among others analyzed for) in both the earlier investigation and the study reported here are aluminum, silicon, iron, titanium, calcium, magnesium, and manganese.

This core is a sample taken from the eastern extension of the Beata Ridge (14°59'N, 68°51'W) from a depth of 4160 m by means of a Kullenberg-type piston corer. It has been described by Ericson (*3*) as being composed of uniform foraminiferal lutite that gives evidence of continuous normal deposition (that is, particle-by-particle) and as being apparently free from sand and graded silt layering, cyclical banding, and color differences. It has been further described by Suess (*4*) as having been selected because of apparent homogeneity of appearance and as being as free as possible from the effects of turbidity currents, erosion, or slumping. Radiocarbon dates established for several horizons of this core by Suess (*4*) would give an average rate of sedimentation of 3.70 cm per 1000 years for the interval included. Paleotemperatures established by Emiliani (*2*) fall within the range 19.7° to 30.4°C.

In order to test the stability of the core, as well as to examine the relations among the various components and particularly their distribution with respect to time, some of the major elements and the paleotemperature have been subjected to a signs test for runs with time considered to be related directly to depth below top of core.

Two general kinds of information

have been sought: Does a trend occur for each element and for paleotemperature for this core considered as a whole? If so, at what depth below top of core does first appearance of such a trend occur? The procedure for the application of the test is as follows: (i) determine the median value; (ii) assign a plus sign to those values above the median and a minus sign to those below it; (iii) consider as a run any sequence of one or more like signs preceded or followed by unlike signs; and (iv) calculate the total number of runs and determine from a table of previously calculated values whether the distribution is random or nonrandom [see Dixon and Massey (*5*)].

With regard to sequential analysis three alternatives present themselves, according to Dixon and Massey (*5*); accept the hypothesis of trend; reject it; or consider the data insufficient and continue sampling. There seems to be no reason why these criteria may not also apply to time series.

For all the elements under consideration, as well as for paleotemperature (Table 1), the number of runs is less than one might be led to expect by a purely random arrangement; it thus appears that a trend exists in every instance.

Hoel (*6*) states, "If a series possesses a long upward, or downward, trend, the total number of runs will tend to be small because of a few long runs at the beginning of the series and at the end of the series. If a series possesses a cycle that is fairly long in terms of the time between observations, the total number of runs will again tend to be small because most of the runs will be longer than expected under randomness. . . . Thus it appears that either a trend or cyclical movements will give rise to a small number of total runs."

The concept of first appearance of a trend below top of core in a deep-sea core has not, to my knowledge, previously appeared in the geologic literature. Determination of first appearance can be accomplished by calculating successive increments below top of core until a trend appears. Calculation is then continued throughout the remainder of the core to ensure that randomness does not reappear. The calculation is rather a tedious process, but it may have pertinence. This segment represents a sector of core that is statistically random with regard to the test under discussion. This may suggest that more detailed study should be undertaken with regard to this section of core. It may also suggest that in certain areas cores under a certain length may not be representative samples of the conditions of sedimentation. That is to say, for a given area is there a meaningful minimum length of core (*7*)?

The segment just prior to first appearance of trend in core A 172-6 for the major components under discussion ($CaCO_3$, iron, aluminum, silicon, and for paleotemperature) falls between 230 and 280 cm below top of core. If one accepts 3.70 cm per 1000 years as an average rate of sedimentation, then the stable part of this core represents a period of some 60,000 to 80,000 years before present (Table 2).

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Table 1. Trend of elements and paleotemperature in core A 172-6. For both paleotemperature and the elements tested, distribution with depth was nonrandom. Paleotemperature data after Emiliani (*2*); $N_1 = N_2$, number of items above and below the median; and *u*, the critical value.

Paleotemperature and elements	$N_1 = N_2$	*u* .025*	*u* .975†	No. of runs
Paleotemperature	38	30	47	14
Iron + aluminum + silicon	47	38	59	22
Silicon	47	38	59	20
Aluminum	47	38	59	16
Iron	47	38	59	20
Titanium	46	37	56	30
Magnesium	47	38	59	30
Manganese	47	38	59	25
Calcium carbonate	47	38	59	26

* Lower critical percentile value at the 5 percent level of significance. † Upper critical percentile value at the 5 percent level of significance.

Table 2. Depth prior to first appearance of trend in core A 172-6. Paleotemperature data after Emiliani (*2*); $N_1 = N_2$, number of items above and below the median; *u*, the critical value.

Elements	Depth below top (cm)	$N_1 = N_2$	Median (%)	*u* .025*	No. of runs
Calcium carbonate	280	14	33.5	9	8
Silicon	230	12	20.35	7	6
Iron	270	14	2.35	9	8
Titanium	170	9	0.30	5	4
Magnesium	170	9	1.30	5	4
Aluminum	270	14	7.6	9	8
Manganese	140	7	0.13	3	2
Paleotemperature					
	250	13	23.65°C	8	7

* Lower critical percentile value at the 5 percent level of significance.

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8. I thank Dr. R. L. Miller, Dr. G. A. Rusnak, Mrs. Kay Weitz, and Miss Donna Meddaugh for their assistance during the course of this project.

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Apatite Crystallites: Effects of Carbonate on Morphology

Abstract. *Carbonate is a substituent in the apatite structure; when present, it limits the size of the growing apatite crystals and so influences their shape that they grow more equiaxed than needle-like. The tendency for carbonate apatites to be equiaxed is related to the nature of the chemical bonds formed in the crystal. The interference of carbonate with the good crystallization of apatite, and its weakening effect on the bonds in the structure, increase the dissolution rate and the solubility, thereby presumably contributing to the susceptibility to caries of dental apatites containing carbonate.*

The inorganic phase of teeth of vertebrates has been identified by x-ray diffraction as belonging to the apatites (*1*)—that is, crystalline basic calcium phosphates typified by hydroxyapatite, $Ca_{10}(PO_4)_6(OH)_2$. Biologic apatites are modified by the presence of other constituents such as carbonate, magnesium,