20 cm/sec, averaging 8 cm/sec. During the remainder of the year the surface waters near the coast flow northward at speeds between 10 and 20 cm/sec. Thus the apparent maximum speed of particle movement is approximately 0.02 to 0.01 that of the surface waters (*15*).

M. GRANT GROSS
Department of Oceanography, University of Washington, Seattle,
and *U.S. National Museum, Washington, D.C.*

JACK L. NELSON
Pacific Northwest Laboratories, Battelle Memorial Institute, Richland, Washington

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11. Samples of marine sediment were collected in August 1963 by combining the uppermost 1 cm from two samples taken at each location by grab-type samplers. The sediment was placed in a plastic jar and dried without desalting. The radioactivity was determined with a NaI(Tl) crystal (7.6 by 7.6 cm) connected to a multichannel γ-ray spectrometer for 100 minutes. The equipment was provided by the Laboratory of Radiation Biology, Univ. of Washington. (See *5* for a discussion of data-reduction procedures.)
12. Samples of river water, collected three times each week and composited on a weekly basis at Pasco, Washington, Hood River, Oregon, and Vancouver, Washington, were immediately filtered through 300-mμ membrane filters to recover the particulate matter. Filters and water samples were dried, and radioactivity was determined with an anticoincidence-shielded multidimensional γ-ray spectrometer [see R. W. Perkins, *Nucl. Instr. Methods* **33**, 71 (1965)].
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Thyrocalcitonin: Ultracentrifugation in Gradients of Sucrose

Abstract. *Analysis of thyrocalcitonin, by density-gradient ultracentrifugation at high speed, showed that its molecular weight (5000 to 6000) is considerably less than was heretofore recognized.*

High-speed ultracentrifugation (*1*) has been used recently to examine the sedimentation of small polypeptides in gradients of sucrose. This method, a modification of the procedure of Martin and Ames (*2*), is advantageous when the purity of a peptide is uncertain because biologic or immunologic activity rather than protein concentration can be used to measure sedimentation rates. While testing the method with several polypeptide hormones, we found that the sedimentation constant for thyrocalcitonin was less than earlier analyses had suggested (*3*). This finding, indicating that unhydrolyzed thyrocalcitonin is a smaller molecule than has been recognized heretofore, may be important to further studies of the chemical characterization of this biologic substance.

Three preparations of thyrocalcitonin were used: each was derived from material extracted from hog thyroid tissue with a solution of 8*M* urea in 0.2*N* HCl. One preparation was a crude extract obtained by the trichloroacetic acid–precipitation method (*3*), the second was fractionated from the crude extract by gel filtration on Sephadex G-75, the third was further chromatographed on carboxymethylcellulose to yield the substance in highly purified form (biologic activity, 10 to 15 MRC units per milligram).

Ultracentrifugation was carried out with the Beckman-Spinco model L2-65 equipped with the SW-65 rotor holding three tubes. The tubes (volume, 4.65 ml) contained buffer in a gradient of 5 to 20 percent sucrose; peptides dissolved in 0.1 ml of buffer were layered atop the sucrose gradients. The centrifuge was operated at 65,000 rev/min at 4°C to yield forces ranging from 118,000*g* at the top to 420,000*g* at the bottom of the gradient.

The sedimentation of porcine corticotropin (molecular weight, 4567) and bovine parathyroid hormone (molecular weight, approximately 9000) had been well characterized (*1*) in this system, and these two homogeneous polypeptides were thus useful reference standards. After centrifugation for 40 hours the contents of each tube were drained from the bottom to give serial fractions of 135 μl each. Albumin (0.5 ml of a 0.1-percent solution) was added to the thyrocalcitonin fractions, which were then stored frozen until tested; thyrocalcitonin was located by injecting fractions into groups of rats used for bioassay (*4*). Corticotropin and parathyroid hormone were detected as protein by the method of Lowry *et al.* (see *5*).

The distribution of corticotropin (*ACTH*), bovine parathyroid hormone (*BPTH*), and the hypocalcemic activity of purified thyrocalcitonin (*TCT*) is shown in Fig. 1. The active fraction of thyrocalcitonin sedimented at a lower speed than did parathyroid hormone —at a speed only slightly higher than did corticotropin. The same relative sedimentation rates of corticotropin and thyrocalcitonin activity were found in an experiment in which acetate buffer, *p*H 4.75, was used. If one assumes that S_{20w} for corticotropin is 0.73 (*6*), S_{20w} for thyrocalcitonin is 0.78 when calculated by the method of Martin and Ames (*2*). In all, three such experiments have been carried out, one with each of the thyrocalcitonin preparations; in all instances the results were similar.

Thus the biologic activity of thyrocalcitonin showed a sedimentation rate too low to be compatible with previous estimates of molecular weight (*3*). This discrepancy cannot be attributed to alterations of thyrocalcitonin through purification (preparations at three different stages of purification gave sim-

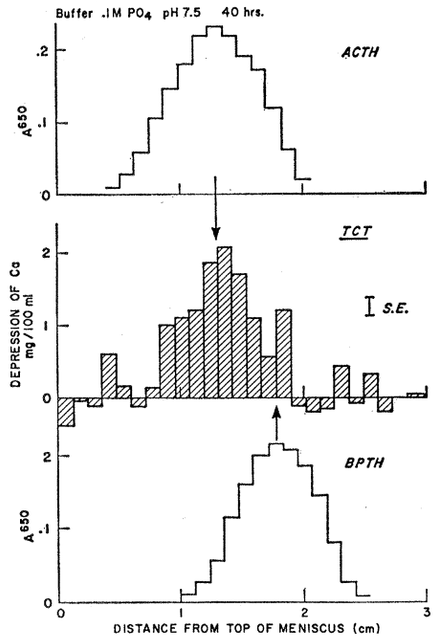

Fig. 1. Distribution of porcine corticotropin (*ACTH*), bovine parathyroid hormone (*BPTH*), and the biological activity of thyrocalcitonin (*TCT*) in a sucrose gradient after ultracentrifugation for 40 hours at 65,000 rev/min. Highly purified (chromatographed on carboxymethylcellulose) thyrocalcitonin (180 μg) in 0.1 ml of buffer was applied to the top of the gradient. Biologic activity for thyrocalcitonin was determined by injecting each fraction into a group of three rats and measuring the depression (serum Ca of uninjected control group minus serum Ca in test group) in serum calcium. The vertical bar (*S.E.*) represents the standard error found for serum calcium in the test and control animals; changes of calcium within 1 S.E. were considered insignificant. The distance from the meniscus to the peak concentration, of protein or of biologic activity, is a direct function of the sedimentation constant. The vertical arrows mark the centers of the *ACTH* and *BPTH* peaks, respectively.

ilar results), or to differences in extraction procedures [the method of extraction with urea, used by us, was almost identical with that of Tennenhouse *et al.* (*3*)]. If one assumes that the hydrodynamic properties of thyrocalcitonin resemble those of most polypeptides of comparable size, the molecular weight is in the range 5000 to 6000—considerably less than the estimate of 8700 (*3*), which was based not on direct biologic testing but on amino acid and equilibrium-sedimentation analyses of polypeptide material.

Another type of thyrocalcitonin has been isolated (*7*) from hot, dilute acid extracts of thyroid glands; it seems to be even lower in molecular weight—approximately 3000—and may represent a smaller active component hydrolyzed from the native substance during the extraction process.

J. L. H. O'Riordan*
National Institutes of Health, Bethesda, Maryland 20014
A. H. Tashjian, Jr.
Harvard School of Dental Medicine, Boston, Massachusetts 02115
P. L. Munson
University of North Carolina, Chapel Hill 27514
P. G. Condliffe†
G. D. Aurbach
National Institutes of Health

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* Present address: Middlesex Hospital, London, W.1, England.
† Present address: c/o European Office, National Institutes of Health, APO 09777, New York.

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Pacific Pleistocene Cores: Faunal Analyses and Geochronology

Abstract. *Two cores from the eastern Pacific were analyzed faunally and dated by the ionium : thorium method. Comparison of the results of these and of similar studies of Atlantic cores indicate that faunal changes, representing changes between the glacial and interglacial stages of the Pleistocene, occurred in both oceans simultaneously.*

Quaternary events have been defined in Atlantic Ocean sediments by foraminiferal changes that have been interpreted as reflecting glacial and interglacial conditions (*1*, *2*). Similar definitions have not been made in Pacific Ocean sediments, but in equatorial-Pacific sediments such events have been defined (*3*) on the basis of total productivity of calcareous and siliceous plankton, and of changes in the reproductive cycle in diatoms. It was our purpose to determine whether or not foraminiferal changes similar to those in the Atlantic can be detected in the Pacific and, if so, whether such changes correspond in time to those in the Atlantic.

Planktonic species larger than 250 μ were counted in 56 surface samples (top 1 cm) of gravity cores (Fig. 1); 300 to 500 individuals were counted in each sample, and 19 species were recognized on the basis of Parker's classification (*4*).

All samples were placed in faunal groups based on vector analysis (*5*). Briefly this method consists in determining the compositionally extreme samples, called end members, of which all other samples are considered to be mixtures. The proportional contribution of each end member to the other samples is then determined. Each end member defines a faunal group composed of samples to which the end member has made a proportional contribution of 70 percent or more. Four faunal groups were thus defined: equatorial, tropical, mid-latitude, and high-latitude groups. Table 1 lists the more abundant species in each group in order of abundance, and Fig. 1 shows the distribution of the groups in the surface-sediment samples.

We present an analysis of the distribution of these groups in two cores, DWBG 98C and DWBG 114. Sediments in the cores are light-tan to buff,

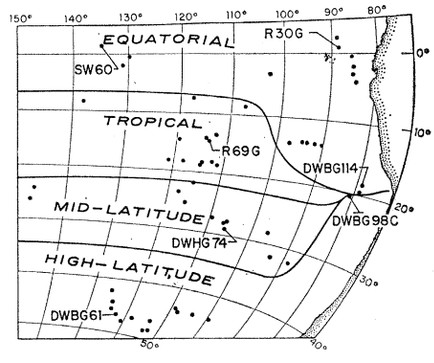

Fig. 1. Sources of 56 cores from the southeast Pacific, and the distribution of the four surface-sediment faunal groups defined by vector analysis. Only the group end members, the two cores discussed in the text, and the equatorial core dated by Arrhenius are identified.