The relative imbalance of the amount of light to the two sides of the card appeared to be the critical variable.

In order to investigate this variable further, an index-card partition was affixed perpendicularly at the midpoint of the line joining the centers of the two circles. In an otherwise dimly illuminated room, the light from a 100-watt bulb in a gooseneck lamp was directed to one side of the card, the partition casting a shadow on the other side. No red filter was in the instrument.

With individual regulation of the distance of the bulb from the card, 16 or 35 subjects reported a blue circle on the shadowed side and a black circle on the bright side, 5 reported purple on the shadowed side and black on the bright side, 3 reported blue on the shadowed side and gray-green on the bright side and, finally, only 4 reported both circles as black. The remaining 7 of the 35 subjects reported other hue combinations for the two circles. The blueness disappeared immediately for some subjects, gradually for others, when the shadowed circle was viewed monocularly. The hue returned immediately with binocular inspection. The results were not affected either by changing the position of the bulb so that the formerly bright side was now shadowed, by initial monocular inspection followed by binocular inspection, or when neutral filters of unlike densities were used to produce one-sided lighting.

It is possible that the yellowish incandescent light was the responsible factor since blue is complementary to yellow. However, the gray-green reported on the bright side by a few subjects offers some difficulty to such an interpretation since this circle is also in yellowish light. Nevertheless, viewing the circles in different illumination may be of value. In white fluorescent light 5 or 12 additional subjects reported blue for the circle on the shadowed side and black for the circle on the bright side, 1 subject reported blue for the shadowed circle and green-gray for the other, and 6 reported black for both circles. For 7 other subjects in daylight, 3 reported the typical blue-black combination, 3 a black-green combination, and one black only. Continuation of this line of experimentation seems desirable because it might provide evidence for an interocular color effect (*2*).

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References and Notes

1. N. Pastore, *Science* **131**, 1400 (1960).
2. I wish to thank Professor B. Hoffmann of the Department of Mathematics of Queens College, who served as a subject, for his stimulating comments on the procedure and the results.

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Discovery of Eocene Sediments in Subsurface of Cape Cod

Abstract. Spores, pollen, and charcoal taken from two wells drilled near the tip of Cape Cod have been identified as Eocene. These are the first Eocene rocks to be identified in Massachusetts. Interpretation of seismic records taken in the Gulf of Maine and Cape Cod Bay will be influenced by this discovery.

Two wells drilled near Provincetown, Mass., on the hook of Cape Cod (Fig. 1) penetrated fluvioglacial material and entered lignitic silts and sand identified as Eocene on the basis of spores, pollen, and foraminifera. Well No. 1 entered Eocene at 86 feet and was still in it at 264 feet. Well No. 2 entered Eocene at 193 feet and was drilled to a total of 203 feet.

The spores and pollen processed by W. S. Hoffmeister from the coal samples at 86 feet 3 inches and at 186 feet from Well No. 1 (Holden's Pond) and at 192 feet 10 inches from Well No. 2 (Stark's Well) have a definite Eocene aspect. Although Upper Cretaceous elements are also present, the evidence points to an Eocene age (probably Lower Eocene). There is a marked similarity between the spores and pollen of these coals and those of a Wilcox (Eocene) sample from Tennessee. Encountering the foraminiferal genus *Elphidium* at 230 feet in the No. 1 well helps to confirm the Eocene age for these sediments, for this genus is not found in material older than Eocene.

No Eocene, in place, had been previously identified from Massachusetts. Coastal plain sediments of Cretaceous and Miocene age crop out at Gay Head on the island of Martha's Vineyard 45 miles southwest of Provincetown. Miocene material resting on granite is known from the subsurface near Duxbury, Mass. (*1*).

In addition to extending the known range of Eocene deposits, discovery of Tertiary sediments beneath the fluvioglacial deposits of Cape Cod is important to marine geophysicists who wish to identify sub-bottom reflections more precisely as to composition and age.

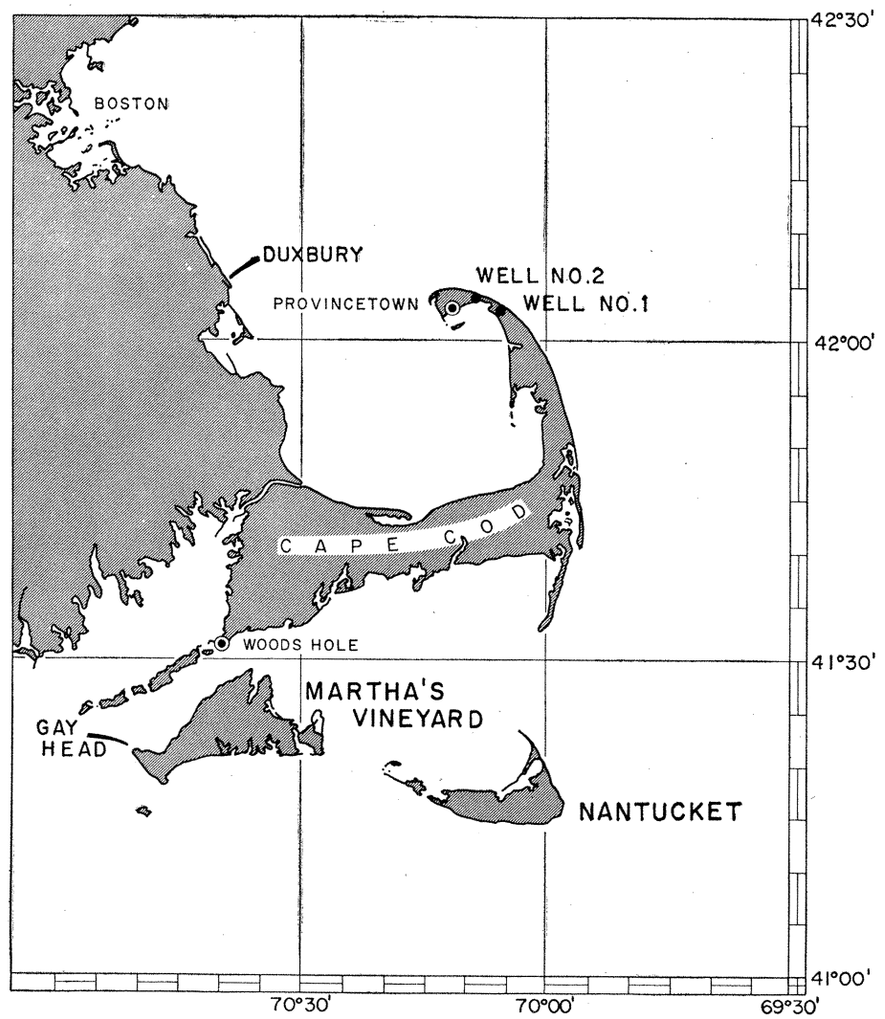

Fig. 1. Cape Cod and surrounding area.

The thickness and extent of Pleistocene deposits overlying reflections interpreted as basement has long been a problem in understanding seismic records from the Cape Cod and Cape Cod Bay area (*2*).

Note added in proof: After this report was submitted for publication, a third well at the westernmost tip of the hook (Race Point) also penetrated Eocene, at 213 feet.

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References and Notes

1. J. B. Woodworth and E. Wigglesworth, "Geography and geology of the region including Cape Cod, the Elizabeth Islands, Nantucket, Martha's Vineyard, No Mans Land, and Block Island," *Museum Comp. Zool., Harvard College* **52**, 15 (1934); B. K. Emerson, "Geology of Massachusetts and Rhode Island," *U.S. Geol. Survey Bull. 597* (1917), 289 pp.
2. The work was sponsored by the geography branch of the Office of Naval Research under contracts Nonr-1245 (00) NR 388-018 and Nonr-2196 (00) NR 083-004. We are particularly grateful to Mr. Frank Stark of Provincetown and Mr. Edmond Dalpe, supervisor of Pilgrim Springs State Park, for permitting us to drill on property under their supervision. We express our thanks to Dr. F. P. Shepard, Dr. Carl Hubbs, and Dr. Hans Seuss, of Scripps Institution of Oceanography, for their cooperation in determining a radiocarbon date (older than 42,000 years) from some of the lignitic material. Thanks are due to Hoffmeister's colleagues at the Jersey Production Research Center and to Dr. L. R. Wilson of the University of Oklahoma, all of whom confirmed an Eocene age for these coals. This report is contribution No. 1128 from the Woods Hole Oceanographic Institution.
* Jersey Production Research Company, Tulsa, Okla.

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Specific Inhibition of $RH_o(D)$ Antibody by Sialic Acids

Abstract. Agglutination of $Rh_o(D)$ erythrocytes by specific antiserum was inhibited by crude and crystalline N-acetylneuraminic acid, less inhibited by its glycoyl derivative, and weakly inhibited by its degradation product, N-acetyl-mannosamine, and by D-mannose. A brain ganglioside containing neuraminic acid and a *Pseudomonas* polysaccharide were even more inhibitory. Inhibition was specific for anti-D sera.

Inhibition of agglutination of $Rh_o(D)$ human red blood cells by specific antiserum has been noted with nucleotides (*1*). Weak inhibition has been observed also with certain monosaccharides, streptomycin, and rutinose, the latter being most active (*2*). Since it was shown that eluates from $Rh_o(D)$ cells treated with mumps virus contained a specific inhibitor (*3*), the sialic acids were investigated as possible anti-Rh inhibitors.

Inhibition tests were performed as described previously (*3*), with trypsinized $Rh_o(D)$-positive red cells and either maximal (4+) or partial (2+) agglutinating dilutions of specific anti-Rh human serum (*4*). Complete inhibition of maximal agglutination occurred with both crude and crystalline preparations of N-acetyl neuraminic acid (NANA) (*5*), and when less antibody was used it was 500 times as effective (Table 1). The *p*H of the initial concentration of crystalline NANA in phosphate-buffered saline (*p*H 7.4) was 3.0, but inhibition by samples adjusted to *p*H values of 6.8 to 7.2 with 1.0*N* NaOH was unaffected. Higher concentrations of such samples were required for complete inhibition after storage for 5 weeks in the refrigerator, possibly due to degradation with the formation of N-acetylmannosamine. A mixture containing equal parts of the latter substance and N-acetyl-glucosamine (*6*) was inhibitory.

Table 1. Effective concentrations of anti-Rh inhibitors. 4+, maximal agglutinating dilution; 2+, partial agglutinating dilution.

Inhibitor	Anti-D control	Inhibition	
		Complete conc.	Partial (μg/0.1 ml)
NANA (75%)*	4+	500	2
NANA (75%)	2+	1–2	
NANA (3 × crystallized)*			
*p*H 3.0	4+	125	60
*p*H 6.4	4+	150	60
*p*H 6.4†	4+	1000	
1:1 N-gluc–N-mann‡	4+	500	5
D-Mannose	4+	1000	60
Beef-brain ganglioside	4+	150	20
Pseudomonas polysaccharide	4+	500	125
	2+	60	1

* Prepared from bovine submaxillary gland. † Stored 5 weeks in refrigerator. ‡ N-gluc, N-acetyl-glucosamine; N-mann, N-acetyl-mannosamine.

The chemically related N-glycoylneuraminic acid also inhibited anti-$Rh_o(D)$ agglutination, but very weakly compared to NANA. Weak inhibition occurred with D-mannose. Two substances of larger molecular-weight, a beef-brain ganglioside containing 17 percent NANA (*5*) and a polysaccharide obtained from a species of *Pseudomonas* (*7*) and suspected of containing NANA, were also effective inhibitors. In fact, these substances were practically as effective as NANA. A ganglioside obtained from human brain (*5*) and the bacterial polysaccharide formed a visible precipitate with anti-$Rh_o(D)$ serum but not with anti-C nor anti-E. Solutions of D-glucose, D-galactose, glucuronic acid, and alpha-D-galacturonic acid were not inhibitory. D-Glucose and D-galactose blocked the inhibition of anti-Rh by partially inhibitory concentrations of NANA, but not by maximal inhibitory concentrations.

The inhibition by purified NANA, N-glycoylneuraminic acid, the ganglioside, and polysaccharide was specific for anti-D, no inhibition being observed with anti-C, anti-E, anti-c, or anti-e sera. The crude NANA, however, demonstrated some inhibition of anti-C and anti-E. Further evidence of specificity was indicated by the production of a positive skin test obtained by the intradermal injection of a dilute solution of the bacterial polysaccharide into the skin of a rabbit passively sensitized 24 hours earlier with anti-$Rh_o(D)$ serum. The reaction varied markedly in severity and time from the reaction produced in a normal rabbit.

Boyd *et al.* (*2*) suggested that the terminal unit of the $Rh_o(D)$ antigen may be one of the sugars belonging to group 4 of Mäkelä's classification (*8*), and noted that streptomycin (a natural glycoside of N-methyl-L-glucosamine) also was inhibitory, while rutinose (6-O (β-L-rhamnosyl)-D-glucose) was five times more effective. Likewise, the larger molecules containing NANA used in our work were more effective inhibitors, and two formed precipitates with anti-Rh serum. It has been suggested (*9*) that sialic (neuraminic) acid occupies a terminal position in gangliosides and mucoproteins. Faillard (*10*) observed that a human brain ganglioside containing 13.2 percent neuraminic acid was resistant to neuramidase, while Gottschalk (*11*) considered that such resistance indicated a ketosidic linkage different from that in compounds susceptible to the enzyme, such as the myxovirus receptor on human erythrocytes.

Since the gangliosides were better inhibitors it may be postulated that the terminal neuraminic acid which is bound in a ketoside linkage conforms more closely to the determinant groups of the $Rh_o(D)$ antigen and exists also in cells containing the antigen. The inhibitory capacity of eluates of human red cells treated with mumps virus or periodate (*3*) might then be due to (i) related products, such as NANA, obtained by the neuramidase action of the virus on the sialic acid of the mucoprotein receptor or its degradation products,