DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

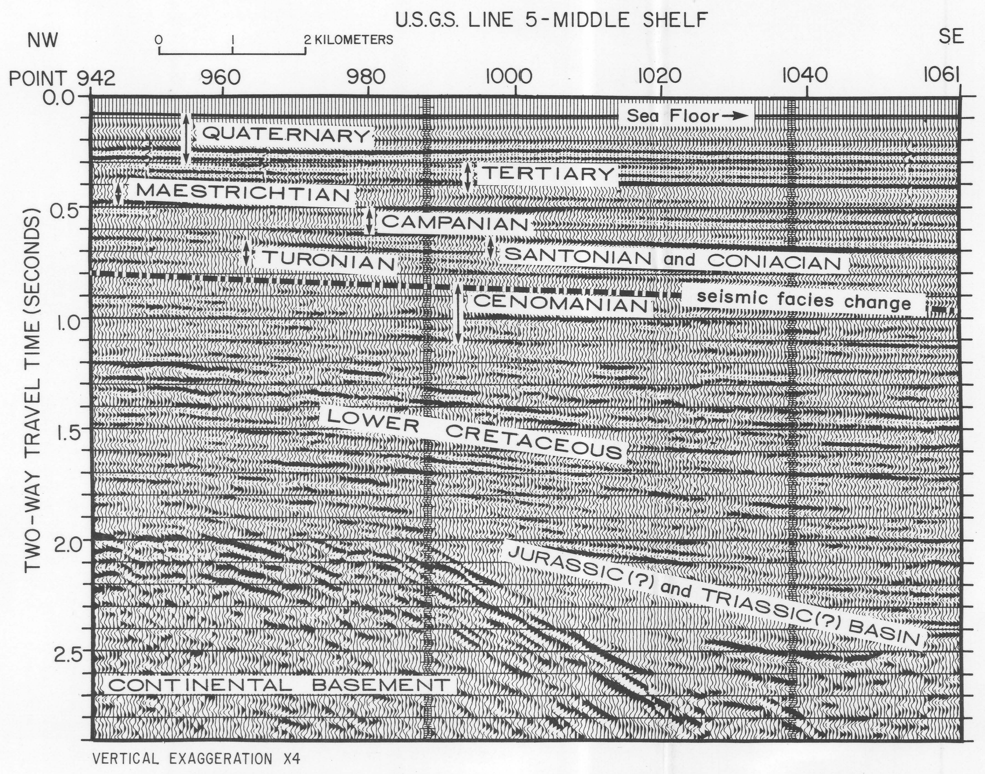
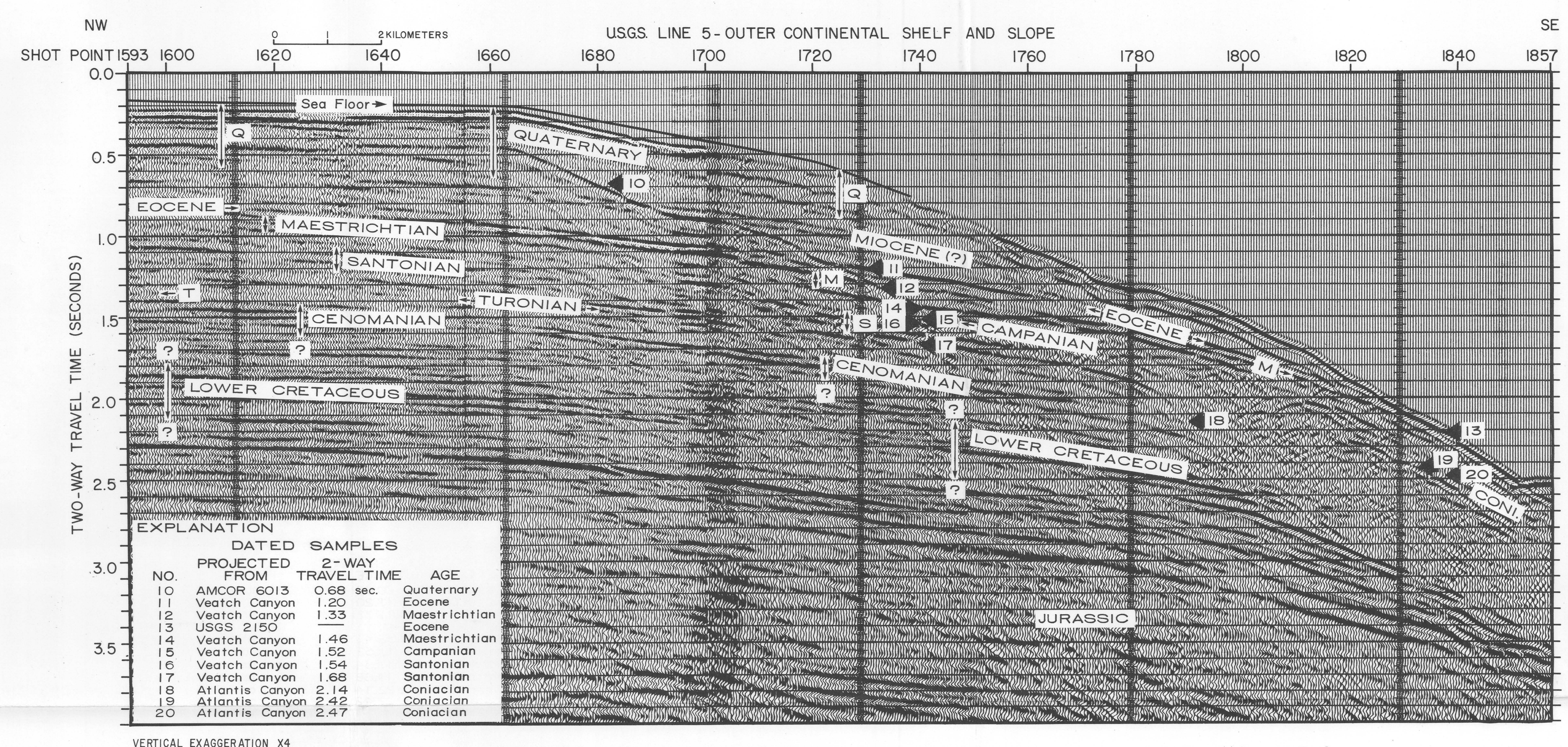


Figure 5.—Time section of USGS line 5 beneath the middle Shelf, 84 km from the landward end of the profile, showing seismic stratigraphy. Continental basement is visible at about 2 seconds beneath shotpoint 942, and it dips to the southeast to form a small basin or graben of probable Jurassic and Triassic age. A thick section (0.9 seconds) of probable Early Cretaceous age overlies basement and the basin fill. Subhorizontal Upper Cretaceous, Tertiary, and Quaternary strata of similar thickness have been correlated with dated reflectors beneath both the inner and outer Shelf and the Continental Slope. The character of the seismic reflectors changes near the top of the Cenomanian interval. Above, the reflectors are continuous, parallel, and of moderate to high intensity; below, they are also layered, but discontinuous. Schlee and others (1976) interpreted this contrast to represent a facies change from shallow marine and terrestrial deposits, shoreward, to a marine sequence, seaward. Brown and Fisher (1977, fig. 10a) have also correlated seismic facies with depositional environments. The discontinuous reflecting horizons below the facies change are here interpreted to represent tabular beds of a shallow marine, distal fan-delta and prodelta facies, and the horizons above the facies changes, characterized by continuity, are thought to represent a transgressive neritic shelf facies that dominated the margin in this area during most of latest Cretaceous and early Tertiary time. The facies contrast rises in the section landward and approaches the top of the seismic record at about shotpoint 700. Studies of the COST G-1 well, drilled on a flank of the Georges Bank Basin about 150 km to the east, have shown that Lower Cretaceous and Jurassic rocks there were deposited in nearshore and nonmarine environments (Amato and Bebout, 1980). Vertical exaggeration is known only at the sea floor.



NO.	PROJECTED FROM	2-WAY TRAVEL TIME	AGE
10	AMCOR 6013	0.68 sec.	Quaternary
11	Veatch Canyon	1.20	Eocene
12	Veatch Canyon	1.33	Maestrichtian
13	USGS 2150	——	Eocene
14	Veatch Canyon	1.46	Maestrichtian
15	Veatch Canyon	1.52	Campanian
16	Veatch Canyon	1.54	Santonian
17	Veatch Canyon	1.68	Santonian
18	Atlantis Canyon	2.14	Coniacian
19	Atlantis Canyon	2.42	Coniacian
20	Atlantis Canyon	2.47	Coniacian

Figure 6.—Time section of USGS line 5 beneath the outer Shelf and Slope showing seismic stratigraphy and localities of dated samples projected to line 5. This profile illustrates the relatively regular spacing and continuous nature of the reflecting horizons in this area. Some shallow horizons beneath the present lower slope are truncated by erosion. The strong reflectors at 3.5 seconds below shotpoint 1850 are related to a structure beneath the upper Rise that has been interpreted to be a carbonate reef or platform of probable Jurassic and Early Cretaceous age (Schlee and others, 1979, figs. 6, 18; Grow and others, 1979, figs. 2a, 9, 10). Turonian and Cenomanian horizons have been traced seaward from the Nantucket region. Late Cretaceous horizons of Santonian Age and younger are based on the projections of samples from the adjacent outer Shelf, Slope, and canyon areas onto line 5. There appears to be a relatively complete Upper Cretaceous section beneath the outer Shelf and upper Slope. The base of the Tertiary is at about 0.8 second at shotpoint 1593 beneath the outer Shelf. Tertiary and Quaternary beds are thin and partly eroded beneath the middle and lower Slope. Eocene limestone is a conspicuous reflecting horizon, and it crops out (sample 13) on the lower Slope near line 5 (Gibson, 1965). Oligocene, Miocene, and Pliocene beds have not been sampled in the immediate area, although they have been found elsewhere on Georges Bank and in submarine canyons (Stetson, 1949; Gibson, 1965; Gibson and others, 1968). They are presumed to be present beneath the thick wedge of Quaternary, chiefly Pleistocene, silty sand and clay beneath the outer Shelf and upper Slope. Vertical exaggeration is known only at the sea floor.

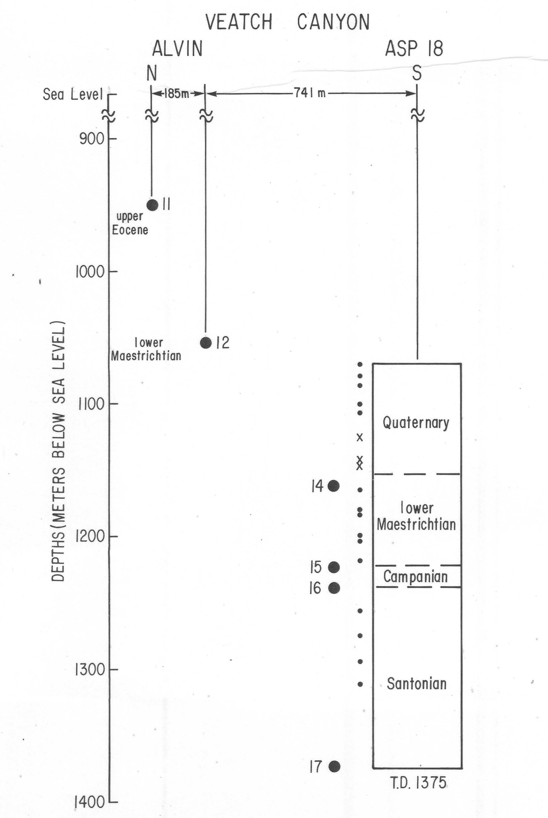
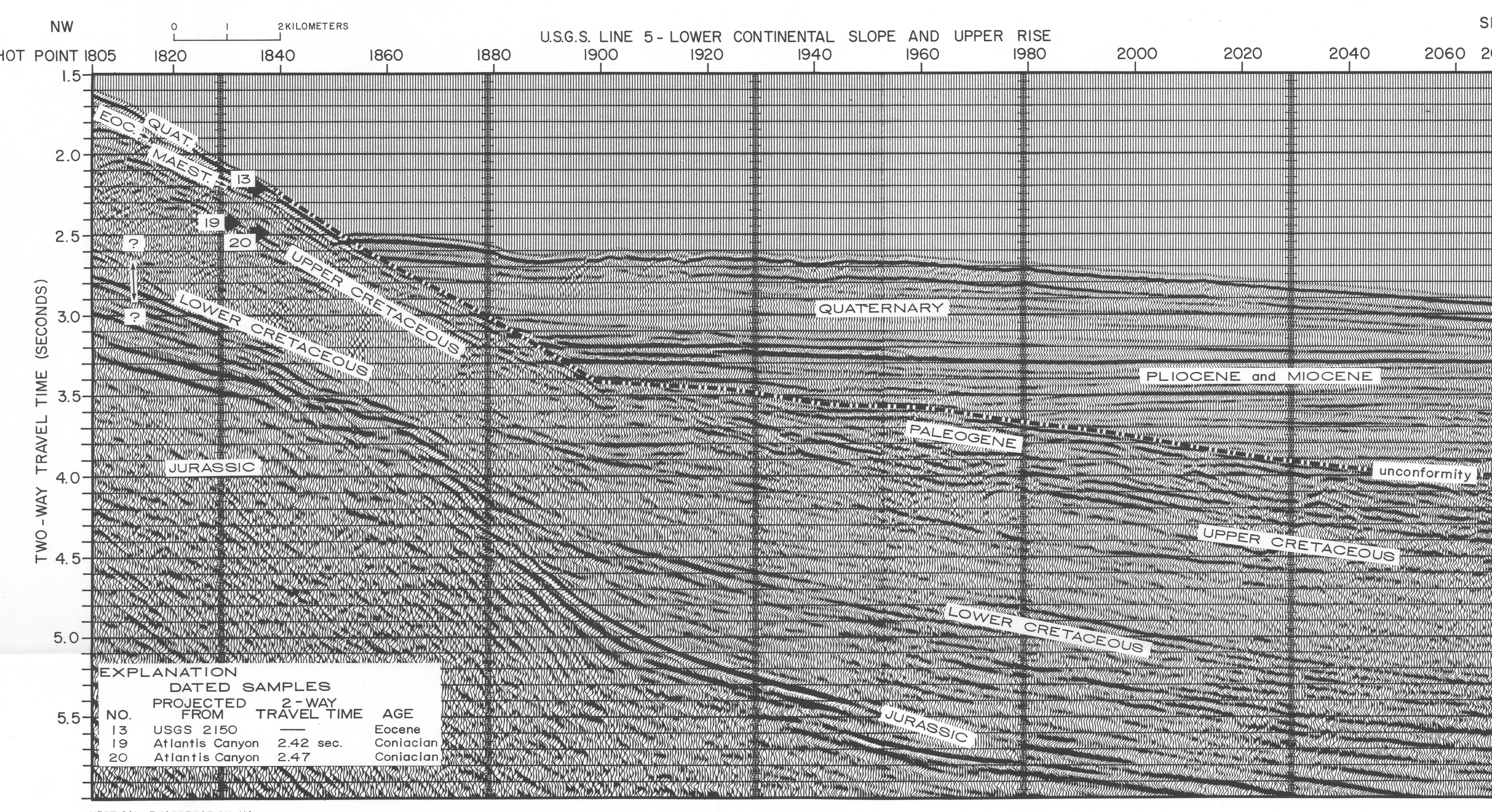


Figure 7.—Stratigraphy of part of Veatch Canyon based on calcareous nannofossils. *Alvin* samples were collected from outcrops on east wall slightly north (updip) of corehole ASP 18 on west wall. Dots indicate stratigraphic position of samples studied; large dots are samples projected onto line 5 (fig. 2, table 1). Barren samples indicated by X.

Figure 8.—Time section of USGS line 5 beneath the lower slope and upper Rise showing seismic stratigraphy and localities of dated samples projected to line 5. The lower part of this section is composed of Jurassic and Lower Cretaceous rocks that form both the reef, or carbonate platform, and the related stratified sequence of onlapping beds that dip seaward from the reef. The inferred carbonate reef is located above the oceanic-continental basement boundary, at the intersection of a large, positive free-air gravity anomaly and the East Coast Magnetic Anomaly (Grow and others, 1979, figs. 2a, 9, 10). The reef structure appears to have effectively separated two centers of deposition in Jurassic and Early Cretaceous time, a landward basin overlying faulted continental crust and a seaward basin on oceanic crust. A major unconformity is present beneath the Rise, and it is probably exposed on the lower Slope between shotpoints 1830 and 1850. This unconformity is also marked by erosionally truncated beds inferred to be of Late Cretaceous and Paleogene age, between shotpoints 1900 and 1930. Lower Eocene limestone was collected from the lower Slope just 3 km west of line 5 (sample 13; Gibson, 1965). The Slope and Rise off New Jersey at DSDP sites 107 and 108 are very similar geometrically and genetically to the area under study in this report. At site 108 on the lower Slope, middle Eocene chalk was found 50 m below the sea floor (Hollister and others, 1972a, fig. 2). Nearby, at site 107 on the upper rise, the corehole bottomed at 88 m in lower Pleistocene silty and sandy clay containing shallow water benthic foraminifers and reworked Eocene and Cretaceous calcareous nannoplankton and foraminifers (Hollister and others, 1972b). The Rise beneath USGS line 5 is a thick sequence of continuous, subhorizontal strata that constitute an onlapping wedge of Quaternary to probable Miocene age. Rise sediments have been derived, in part, from continental sources and transported across the shelf and through submarine canyons. Other sources include the pelagic realm and erosional debris from older rocks exposed in the canyons and on the Slope. The rise prism has advanced landward across an unconformity of uncertain age that is probably diachronous and may range in age from Eocene to Quaternary. Neogene sedimentation has been disjunct, and deposition has been heaviest in two depocenters, one beneath the outer Shelf and upper Slope (fig. 6) and the other beneath the Rise. The present Shelf and upper Slope formed by a complex process of progradation and erosional retreat, whereas the Rise has been built by onlapping beds probably originating, in part, as turbidite deposits. Vertical exaggeration is known only at the sea floor.



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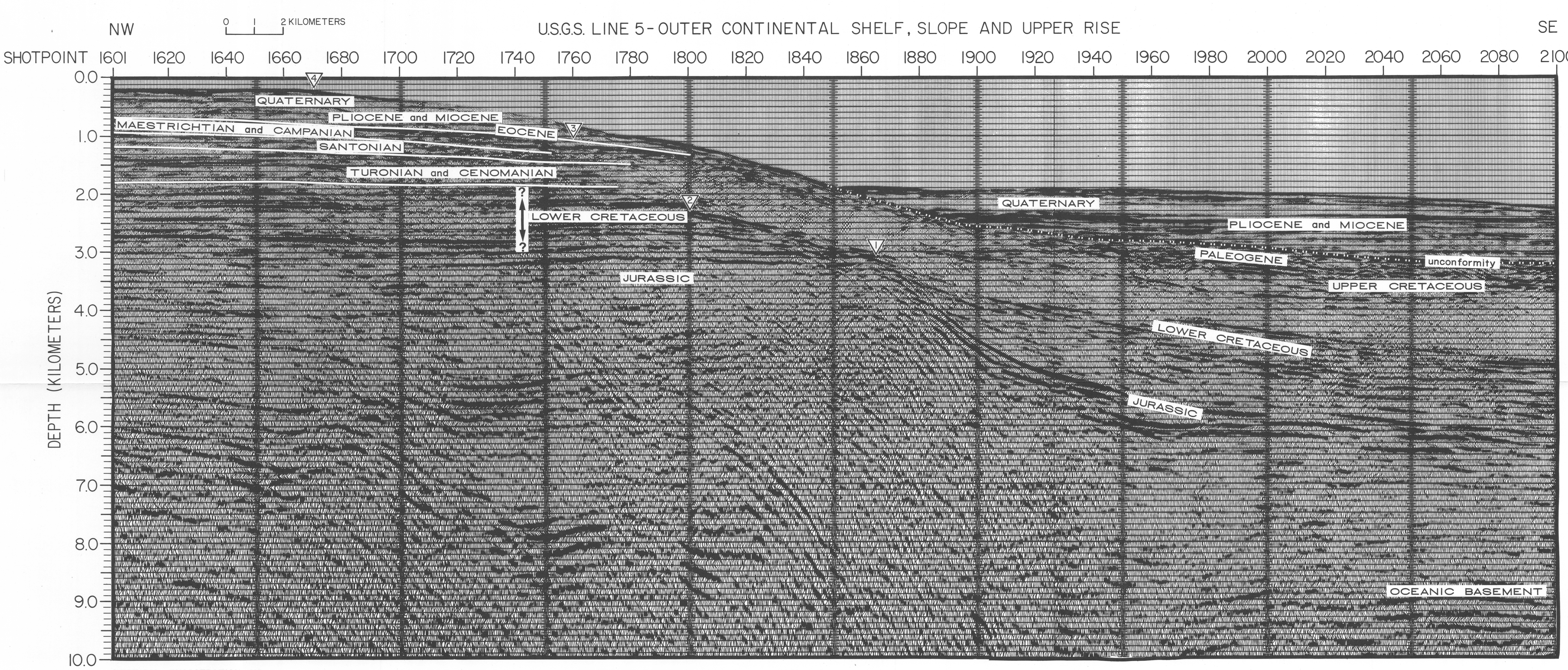

Figure 9.—Depth section of USGS line 5 beneath the outer Shelf, Slope, and upper Rise showing seismic stratigraphy. This depth profile gives a more realistic picture than a time section of the configuration of beds and the shapes of sedimentary bodies in this region. Jurassic and Lower Cretaceous strata behind the reef complex (location 1) dip landward into a basin beneath the outer shelf, and seaward, a coeval wedge of rise deposits overlies the carbonate platform front. A shelf edge formed at the reef front during the Jurassic, and it remained there into the Early Cretaceous (Grow and others, 1979, fig. 9). In the Early Cretaceous, as the Shelf and Rise grew to lap over the reef and form a sigmoidal Shelf-Slope-Rise configuration, the Shelf edge shifted 6-7 km landward to location 2 (shotpoint 1800). The Upper Cretaceous and lower Tertiary sequence is represented by evenly bedded continuous reflectors beneath the Shelf, whereas Slope and Rise strata are seismically almost transparent. A smooth Shelf-Slope-Rise transition has been preserved, and there is no obvious wedge of onlapping rise sediments. During the Late Cretaceous, the shelf edge was probably between shotpoints 1800 and 1820, above location 2, but by Eocene time it was near location 3 (shotpoint 1760), about 4 km landward of its position in the Early Cretaceous. The identification of paleoshelf edges is made difficult by the flattening of beds during compaction and subsidence and by the effects of erosion. The configuration of the Slope and Rise during the Late Cretaceous and early Tertiary certainly did not follow the present top of the Paleogene deposits, because the truncated reflectors at the unconformity beneath the present Rise indicate that an unknown volume of sediment has been eroded there. The upper Tertiary and Quaternary deposits beneath both the outer Shelf and upper Slope and the Rise are two distinct sedimentary bodies separated by the lower Slope where older strata are exposed. The present shelf edge is, at location 4 (shotpoint 1670), about 9 km landward of its position in the early Tertiary.

CONTINENTAL MARGIN STRATIGRAPHY ALONG THE U.S. GEOLOGICAL SURVEY SEISMIC LINE 5--LONG ISLAND PLATFORM AND WESTERN GEORGES BANK BASIN

By
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1981

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