INTRODUCTION

The continental margins in the Bay of Biscay and off Galicia-Portugal (Fig. 1) appear now to be stable margins, as are most Atlantic margins. But they have a singularity that greatly complicates their interpretation: the present structure is due not only to Atlantic history during the Mesozoic and Cenozoic but also to the Tethys (Mediterranean) history. They are the result of well-known distension movements on the margins formed by rifting as well as of compression movements responsible for building the Pyrenees.

Therefore, the following elements must be distinguished: the Armorican margin and its onshore prolongation in the Aquitaine Basin, both of which remained stable during their entire history; the North Spanish margin and the Pyrenean zone, which were active especially in the late Cretaceous and the early Cenozoic; and the Galicia-Portugal margin north of Nazaré, which remained stable during its entire history.

A great deal of geological and geophysical work has been done in this area. Most of it was brought together in 1970 at the Symposium on the Structural History of the Bay of Biscay and published in 1971. Important data were provided by Leg XII of the GLOMAR CHALLENGER (Laughton, et al., 1972). But the most important new data obtained since then come from geological reinterpretations made by oil companies in the Aquitaine Basin on the basis of new ideas on the Bay of Biscay. These data were the subject of a special meeting of the Geological Society of France, whose details were published in 1972.

CONTINENTAL MARGIN OFF GALICIA AND PORTUGAL, NORTH OF NAZARE

The bathymetric maps of this region, compiled by Berthois et al. (1964) and Black et al. (1964) reveal two units north of the Nazaré Canyon (Figs. 1 and 2): Offshore from the Portugal sedimentary basin, the continental shelf is 40-50 km wide. Further north, all the way to Cape Finisterre, the continental shelf is about 30 km wide. In the west, it is prolonged for nearly 200 km by a marginal plateau at an intermediate depth, with seamounts such as the Galicia Banks and the Vigo and Porto seamounts. There is a considerable shift in latitude between this marginal plateau and the north Spanish continental margin.

The Portugal sedimentary basin has its northern end at about 40°30’N and is 4-5 km thick. It is made up of an evaporitic series from the Triassic and the Lias, a Jurassic series 3,000-4,000 m thick, and a Cretaceous and Tertiary series hardly more than 1,000-1,500 m thick. From the structural standpoint, it is disturbed by long diapiric structures trending north-south. It is affected also by a southwest-trending transverse-fault zone, probably transcurrent, located approximately in the prolongation of Nazaré Canyon. Offshore, south of the canyon, lie the Farilhoes and Berlingas islands, formed by outcrops of the Hercynian basement.

Black et al. (1964) were the first to study the Galicia Banks area by bathymetry, magnetism, seismic refraction, and dredging. They showed that the nonmagnetic submarine plateaus were probably collapsed blocks of continental origin. Stride et al. (1969) then made a sparker seismic-reflection profile from Cape Finisterre to the Galicia Bank. In 1969 a cruise carried out by IFP and SNPA provided new data on the continental margin between 40 and 43°N. The Flexotir seismic-reflection profiles were digitally recorded with a 12-trace streamer. They were then processed to obtain a CDP coverage. In addition, Lamboy and Dupeuble (1971), Boillot and Musellec (1972), and Boillot et al. (1972) studied the superficial structure of the Galicia-Portugal continental shelf using sparker seismic-reflection profiles as well as numerous cores and dredged samples. All these data define the major structural features of the continental margin in this area.

Margin Off the Portugal Sedimentary Basin (40°N)

Deep seismic-reflection profiles show the prolongation of the onshore basin onto the continental shelf with comparable thicknesses. Diapirs caused by Lias-Triassic salt are also visible. Some of them are piercing the bottom of the sea and cause the outcropping of a ring of older formations. These formations have been studied by Boillot et al. (1972), who revealed the presence of a probable Early Cretaceous with a Weald facies, a transgressive Late Cretaceous, and a mainly neritic Tertiary. On the whole, the Portugal basin can thus be seen to continue onto the continental shelf, with the deposits mainly remaining of the shelf type, although with more open marine facies.

Farther west, the break of the continental shelf corresponds to the edge of a Tertiary progradation slope. Beyond this, the horizons attributed to the Tertiary or Late Cretaceous become steadily deep-
er, to around 2,500-3,000 m. Here, a very large fault displaces the reflector attributed to the Late Cretaceous by nearly 3 sec DT (two-way time), while the sea-bottom quickly drops to a depth of 4,000 m. In the great depths a new series (formation 3) appears and becomes quite thick in the low points or grabens in the acoustic basement, where it reaches 1-1.5 sec. This series, which is found throughout the Galicia-Portugal margin (Fig. 2) is attributed mainly to a marine lower Cretaceous that has filled in the hollows in the substratum of the margin which collapsed during the distension movements linked to the opening up of the Atlantic at that time, as in the Bay of Biscay.

Continental Margin from the Northern Portugal Basin to Cape Finisterre

Farther north, at the latitude of the Porto Seamount, the pattern is different. On the continental shelf the sedimentary series are thinner than farther south and do not reveal any structures linked to diapirs. After the shelf break (profile OC 103, Fig. 3) the depths plunge quickly to 2,000-2,500 m in connection with a very large vertical fault zone. Between this escarpment and Porto Seamount, which is a basement horst and not a diapirc structure as assumed by Pautot et al. (1970), a very thick sedimentary basin of nearly 4 sec develops, i.e., at least 5,000-6,000 m. The underlying series is attributed to the Late Cretaceous-Tertiary (formations 1 and 2) with nearly 1.6 sec thickness; there is thus a thick fill of nearly 3 sec, attributed to the lower Cretaceous (formation 3).

The deep reflections may be Jurassic, and two quite visible piercing structures can perhaps be related to Lias-Triassic evaporites. On the Porto Seamount horst, where it is evident that the continental basement has been broken and collapsed by distension, only 0.4 sec of sediments can be found on