shoulder of the larger Z^0 bump. Because of the greater mass of the top quark, toponium will be a smaller system than either J/ψ or ψ , and its detailed level-structure will give evidence for the behaviour of the quantum-chromodynamic potential at very short range. Other ways of investigating quantum chromodynamics in e^+e^- annihilation and the scattering of virtual photons from virtual photons, were reviewed by Ahmed Ali (DESY, Hamburg).

The totally new effects that might appear once the natural energy scale of the weak interactions is reached were reviewed by John Ellis (CERN). The cause of the large masses of the $W^\pm$ and Z^0 , together with the generations of heavy quarks, is one of the great open questions in current theory. These masses may be generated by the Higgs-Kibble mechanism, which introduces a new heavy scalar particle that pervades space, modifying the vacuum and coupling most strongly to the heavy particles. No one has yet identified corresponding free Higgs bosons, although many strategies to look for them have been suggested, especially in Z^0 or toponium decay. But other more complicated theoretical schemes exist which would not necessarily need simple Higgs particles. If their thresholds are reached at LEP, the effects may be seen in anomalous events like the UA1 mono-jets, which some have tried to explain in terms of supersymmetric theories (see J. Ellis, *Nature* 313, 626; 1985).

Herwig Schopper, the director-general of CERN, announced that he plans an early upgrading of LEP from the initial (50 + 50) GeV LEP 1 machine, which starts work in 1989, to the (100 + 100) GeV LEP 2. The only change needed would be to replace the accelerating radiofrequency cavities. Great progress has been made in developing the required superconducting cavities and some of them will even be included in LEP 1.

Schopper's announcement was particularly interesting after the discussion of the physics to be done at LEP 2 energies (Roberto Peccei, DESY). The bankable study, which cannot be done on any other machine, is to produce W^+W^- pairs directly via the fundamental couplings of electroweak theory. This gives yet another probe of higher order corrections. If the Higgs particle has not yet been seen, it will only be through such higher order electroweak studies that we will be able to differentiate between the different candidate models that generate masses. There is also more speculative work to be done at the higher LEP 2 energies, continuing the search for the effects of supersymmetry or for some new heavier scale of composite substructure that may underlie the present particles. The Jamboree showed that LEP has an even longer list than before of important specific questions to answer. If there are surprises as well, it will be a bonus. □

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Ocean Drilling Program

Shakedown and sea trials

from the Leg 100 shipboard scientific party*

THE Ocean Drilling Program (ODP), successor to the Deep Sea Drilling Project (DSDP), commenced its field operations on 11 January 1985 with an 18-day shakedown and sea-trials cruise (Leg 100), departing from Pascagoula, Mississippi and arriving at Miami, Florida. The cruise came after an extensive conversion and overhaul of the newly chartered drilling vessel *Joides Resolution*. This drillship is 470 feet long and 70 feet wide with a displacement of 16,596 tons, a derrick towering 217 feet above the waterline, and the ability to employ a drillstring of 30,000 feet (9,146 m) in water depths up to 27,000 feet (8,632 m).

Prior to the shakedown cruise, a seven-storey main laboratory structure, geophysics laboratory and a separate library and study area were constructed aboard the vessel. Additional scientific, office and storage space has been provided; major modifications to the ship's dynamic positioning system, which enables the vessel to maintain a relatively fixed position over the hole being drilled in the sea bottom, now enable long-based and short-based line systems, as well as the original ultra-short-based line system, to be used. The system is supported by 12 powerful 750 horsepower thrusters, as well as by two main shafts each with six 750 horsepower motors. In addition, a 400-ton heave compensator, which keeps the drillstring stable relative to the seafloor, has been installed. These are only a few of the numerous modifications made to the original rig.

The science laboratories contain a complete array of seagoing research equipment that will allow shipboard scientists to carry out a wide range of physical and chemical analyses on the core samples recovered by drilling. There are laboratories to study sedimentology, physical properties, palaeomagnetism, chemistry, gas analysis, palaeontology, petrology, thin section, X-ray diffraction and fluorescence microscopy, scanning electron microscopy, and downhole measurements. In addition, facilities for photography, electronics, and refrigerated core storage are available. While the ship is in transit between drill sites, digital single-channel seismics are recorded and processed in the on-board geophysics laboratory. There is also a research-oriented computer system which is designed to perform as many routine clerical and arithmetical tasks as possible. A pair of VAX computers serve as a central processor and data library for 50 microcomputers distributed throughout the laboratories.

During the inaugural cruise, three holes were drilled at site 625, near De Soto Canyon, west Florida Shelf (see figure). The scientific objectives were to document

the sedimentological, palaeontological, geochemical, geotechnical and geomagnetic characteristics of the sedimentary sequences, and to correlate alternating sedimentary and erosive sequences to worldwide changes in sea level over the past several million years. The principal operational objectives were to test the rotary advanced piston coring (APC), and extended core barrel (XCB) drilling and coring systems, and to familiarize the drillship's crew with core handling and sampling procedures.

The deepest of the three holes drilled was 625B, which penetrated to 235.2 m sub-bottom. This hole was continuously cored with the APC system through 197.1 m of Plio-Pleistocene section. The XCB system continued to termination depth in the Lower Pliocene. At the third hole (625C), an attempt was made to obtain a complete section of the uppermost Quaternary by overlapping the HPC cores taken in the previous hole between 5 and 44.5 m sub-

Location map for site 625.

bottom. A visual comparison between the overlapping piston cores indicates that the sequences in each are closely matched. On the basis of physical properties and magnetic susceptibility data, we believe that no more than about 10 cm of material remained unsampled after the double HPC coring. Since this operation was accomplished in hostile sea conditions, it clearly demonstrates the usefulness and importance of the heave compensator.

During Leg 100, the onboard scientific, drilling and operational equipment was tested under varying sea conditions and generally performed to, or even exceeded, expectations. A fairly large number of adjustments or rearrangements of equipment were required but the minor nature of these is illustrated by the fact that the ship was able to depart on 31 January, after only two days in port, for the first fully operational, internationally staffed cruise of the Ocean Drilling Program, Leg 101. □

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