T 130

THE ARAKAPAS FAULT BELT, CYPRUS: A FOSSIL TRANSFORM FAULT

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It is widely accepted that the Troodos massif of Cyprus is a fragment of oceanic lithosphere formed at a constructive margin some 85 m.y. ago. The Arakapas Fault Belt is an elongate east-west fracture zone where an intensely brecciated basement of ocean crust is overlain by a variety of basic volcanic rocks and clastic sediments. Whilst constructive margin processes were still active elsewhere on the massif, the Arakapas Fault Belt existed as a trough with a rugged bathymetry formed of numerous fracture zones between which were relatively undeformed blocks. The north-south trending dykes of the main massif swing progressively westward into an east-west alignment as the fault is approached. This deviation could be due to horizontal drag along the fault but dyke injection into a sygmoidal stress field prior to the development of the fault is considered. Onto the rugged bathymetry, in which fault scarps and associated scree deposits are still identifiable, basic lavas were extruded, and a variety of sediments, produced by the submarine erosion of bathymetric highs within and on the flank of the trough, deposited. Some of the volcanic products within the fault belt are more primitive than those of the main massif and this is interpreted as being due to a higher percentage melt in the underlying mantle and easier egress for the basaltic magmas. Relevantly, the metamorphic imprint indicates that the thermal gradient in the fault zone was steeper than elsewhere on the massif and that quantities of circulating sea-water were greater. Later, once this part of the fault zone had moved well outside the constructive margin offset, serpentinite masses were emplaced and normal and reverse faulting occurred. Structural, petrochemical and sedimentary features combine to suggest that the Arakapas Fault Belt is a fossil transform fault.

T 131

A THEORY OF SUBSTRATAL CREEP UNDER VARYING OVERBURDEN WITH APPLICATIONS TO TECTONICS

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Lubricating squeeze flow of a ductile substratum under varying overburden is characteristic of tectonics in salt basins, deltas, and probably other more deepseated settings. An approximate theory, valid for slowly varying overburden and substratum thicknesses, is presented, which treats the substratum as a lubricating layer exhibiting power law creep and the overburden as a shear layer deforming by inhomogeneous simple shear along the vertical, both layers being subjected to gravity alone. This furnishes a single differential equation in h(x,t), the thickness of the substratum, coupled dynamically to the overburden through the pressure gradient $\partial p/\partial x$ driving the flow in the substratum

$$\partial/\partial x[h^{n+2}(\partial p/\partial x)^n] = \kappa_n \partial h/\partial t,$$

where n = power law exponent, κ_n = const. For negligible shearing resistance in the overburden $\partial p/\partial x$ is proportional to β, the overburden gradient, but the average flow rate in the substratum is proportional to $\beta^n h^{n+1}$. Thus, layer thickness strongly determines growth rates of squeeze flow structures. Furthermore squeeze flow in a substratum of varying thickness will force folds into the overburden that travel in the direction of decreasing load with a speed proportional to $\beta^n h^{n+1}$. In contrast with fluid dynamical theories of gravitational instability, buckling occurs in an elastic overburden under transverse loading by a buoyant substratum only if sedimentation or erosion take place. From the various applications of the theory, the prediapiric stage in salt tectonics is chosen for illustration.

Oceanic Lithosphere I: Ocean Bottom Seismology, etc.

Arlington-Alexandria, Thursday 1330h

A. Murphy (Lamont-Doherty Geological Observatory) and *A. K. Ibrahim* (University of Texas), Presiding

T 132

EARTHQUAKE AND SEISMIC REFRACTION RESULTS FROM OCEAN BOTTOM SEISMOMETERS OFF BRITISH COLUMBIA

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Two deployments of 3 ocean bottom seismometers near the north eastern end of the Explorer ridge were used to study the seismicity of this triple point area and for seismic refraction. Approximately 1000 earthquakes were detected by a 35 km equidimensional array, of which 100 were simultaneously recorded with sufficient amplitude for accurate location. The seismicity is located primarily on the Explorer and Delwood spreading centers and on the 100 km long transform fault joining them. The Juan de Fuca and Explorer plates appear to be moving as rigid independent units despite their small size. Eighty-two explosive shots plus a 1000 cu. in. airgun source along a 75 km line perpendicular to the ridge gave a simple well defined crustal structure, but a very low mantle velocity.

T 133

ANALYSIS OF SURVEY DATA FROM A TWO-DIMENSIONAL ARRAY OF OCEAN BOTTOM SEISMOGRAPHS

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A two-dimensional array of OBS's was placed on a proposed deep-hole drilling site as part of a survey conducted for the DSDP/IPOD project. The survey was located at about 9°N and 105°W, northwest of the junction of the Siqueiros fracture zone and the East Pacific Rise, and was centered on 1.6 my old crust. The north-south lines show evidence of a low velocity zone, while the east-west lines show no such feature. The most westerly shots are strongly attenuated by the presence of a seamount. Reparameterization of the travel times in terms of delay time τ and apparent slowness p is used to obtain extremal bounds on the crustal velocity models. Independent measures of p are accomplished by the use of maximum likelihood frequency wavenumber analysis. Refinement of the velocity models is accomplished using a modified reflectivity method to calculate synthetic seismograms. This method utilizes a first order asymptotic approximation to the propagator matrix for a continuously varying vertically homogeneous isotropic elastic medium as opposed to the homogeneous layer Haskell matrix approximation used by Fuchs and Muller.

T 134

A COMBINED OCEAN-BOTTOM SEISMOGRAPH AND LAND-BASED NETWORK SEISMIC EXPERIMENT IN THE N. E. CARIBBEAN

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During November 1976 three ocean-bottom seismographs (OBS) were successfully deployed in the Puerto Rico Trench north of the Virgin Islands in a combined seismic experiment with a nine station land-based network. In addition to the passive phase of the experiment, recording earthquakes on both types of instrumentation, two one-ton shots were detonated to calibrate the velocity structure beneath the combined array of seismometers.

Two preliminary observations to date include; a) Two OBS units have been played back - the first unit recorded 650 events in 9 1/2 days; the second unit recorded 1150 events in 6 1/2 days, including about 850 events of a swarm. The land network usually records four to five events per day. b) Approximately 50 events recorded by the OBS's were also recorded by a sufficient number of land stations to permit good quality locations. These events will serve as a data base to determine the bias in the locations obtained from land-station data. c) This combined data base will also be used in an inversion program to obtain the velocity structure of the area. Travel time data from the two shots, which were recorded at nearly all stations, will also be an input to determining the velocity structure.

T 135

SEISMICITY OF THE NORTHEASTERN CARIBBEAN: DATA FROM A NEW SEISMIC NETWORK

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A network of 15 short-period seismograph stations recently became operational in the northeastern Caribbean, eastern Puerto Rico, the Virgin Islands, and the northern Lesser Antilles. Data from the individual stations are transmitted by low-power FM radio to a central recording station on St. Thomas in the Virgin Islands.

In this paper we will describe the preliminary results that have been obtained from this data set. These include the following:

a) The microseismicity recorded by the new network during the past 20 months mimics the spatial distribution of teleseismic activity for the last 25 years. In particular, an area with a gap in $m_b > 6$ activity displays a lower level of microearthquake activity than surrounding areas, and the area of the Anegada Trough has a significant level of activity including several events at a depth of about 75 km.

b) At least two large swarms (500 - 1000 recorded events) have occurred in the Puerto Rico Trench, an area which has not had a great earthquake in about 400 years - the extent of available history. In contrast the area of the Anegada Trough which had a great earthquake in 1867 has not produced a recordable swarm to date.

c) An inversion program is being applied to the data to obtain a better understanding of the complicated velocity structure within the area of the network.

T 136

RESULTS FROM SEISMIC REFRACTION EXPERIMENTS IN THE NEW HEBRIDES USING OCEAN BOTTOM SEISMOGRAPHS

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Refraction experiments were conducted at four locations in the New Hebrides as a part of a French/American program of seismic studies in the region. The preliminary investigation reported here utilized a single airgun source, and the Texas Ocean Bottom seismograph (OBS). The airgun source provided useful data to a range of about 13 km. Two of the lines were run near the New Hebrides trench axis; one 19 km west of the axis, and the other 28 km east of the axis. A third line was located on the Island arc structure, and the fourth line was located eastward of the Island arc on the Fiji plateau. Based on primary and secondary arrivals obtained from the OBS records, travel-time curves and amplitude-distance curves have been constructed. Water waves were used to calculate the range for each shot. The velocities obtained vary between 1.9 km/sec and 7.6 km/sec. The 7.6 km/sec horizon observed only in the Fiji plateau profile may correspond to mantle at a depth of 10.5 km.