and 25 cm. Seismic slip here occurs in the 12-14 km depth range. Northwest of the gap seismic slip occurs between depths of 14-18 km.

The first observation indicates that the maximum depth of the seismogenic zone along different sections of the San Jacinto fault zone is in part controlled by heat flow and can vary by as much as a factor of two. These variations may affect the size and repeat time of large earthquakes along different fault segments and also may affect various observable phenomenon preceding large earthquakes. Observation 2 suggests that the upper 8-14 km of most of the fault zone is locked. That most seismicity and seismic slip *occurs at the base of the seismogenic zone* and not above suggests that the deeper parts of the fault are under higher stress than the shallower parts. This is in accord with the idea that tectonic loading of the brittle crust comes from below and implies that some seismological precursors to future large events might be found near the base of the brittle fault zone. Observation 3 indicates that the locked zone near the Anza gap extends over a large depth range with stress concentrations at the bottom of the locked zone.

S11C-08 1100H

Block Rotation Along the Southern San Jacinto Fault Zone

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The 100 km long portion of the San Jacinto fault zone (SJFZ) from the Anza Plateau to the Imperial Valley is characterized by a series of northwest strands which bound the zone and many northeast cross faults which span the 3 to 7 km wide zone. Although major earthquakes are associated with right-lateral ruptures on the northwest strands, aftershocks and background seismicity occupy the entire fault zone and are often associated with left-lateral cross faults. A system of faults and blocks across Coyote Ridge at the northwestern end of this zone could transfer right-lateral shear between two overlapping strands by rapid clockwise rotation. Southeast of Coyote Ridge, the SJFZ occupies a broad valley characterized by deformed Plio-Quaternary terrestrial clastics. Several cross faults are recognized in this young structural domain. Paleomagnetic data from poorly lithified sediments of the Ocatillo formation in the Borrego Badlands and straddling the Inspiration Point cross-fault, yield normal and reversed characteristic magnetizations that deviate from geomagnetic north and south by 20° to 30° clockwise. This rotation has occurred in the last 0.7 to 1.0 my, since the sediment is younger than 1 my and the sampled reversal is older than 0.7 my. The minimum rate of rotation is then 0.3-0.7 μrad/y, corresponding to a minimum overall displacement rate of 0.2-0.5 cm/y for the SJFZ. Offset channels and a cluster of 1968 aftershocks associated with the Inspiration Point fault suggest ongoing left slip and clockwise rotation. The triangular Clark Basin between the Borrego Badlands and Coyote Mtn. may reflect pull-apart fanning between rotating and translating portions of the SJFZ. A detailed resolution of block kinematics within fault zones such as the SJFZ at both the geologic and geodetic time scale may help to understand the pattern of deformation leading to a major rupture.

S11C-09 1115H

Focal Mechanisms and State of Stress on the San Andreas Fault in Southern California

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The state of stress on the San Andreas fault has been analyzed from focal mechanisms of earthquakes with epicenters within 10km of the active trace of the San Andreas fault from Parkfield to the Salton Sea. Focal mechanisms were determined from first motions for over 100 $M \geq 2.6$ earthquakes that occurred between 1978 and August 1985. Distinct stress regimes can be identified for 3 regions of the southern San Andreas - the Carrizo Plains, Mojave and San Gorgonio sections. The Carrizo Plains section, from Parkfield to Fort Tejon, has very few earthquakes and focal mechanisms that consistently show right lateral strike-slip parallel to the plate motion vector (N40°W). The Mojave section, from Fort Tejon to Cajon Pass, has a slightly higher rate of seismic activity and mechanisms that predominately show oblique thrusting subparallel to the local strike of the San Andreas (N60°W). The San Gorgonio section, from Cajon Pass to the Salton Sea, has the highest rate of seismicity and shows both right lateral strike-slip and oblique normal faulting. The fault planes strike from N0°W to N50°W and thus are subparallel to the plate motion vector but not to the local strike of the San Andreas. Inverting the focal mechanism data for the stress tensor using the method of Angelier (1984) shows that all three regions have a horizontal, north-south striking, maximum principal stress, a vertical intermediate principal stress and a horizontal, east-west striking minimum principal stress. The difference between the regions is in the ratio of the magnitudes of the stresses, $\phi = (\sigma_2 - \sigma_3)/(\sigma_1 - \sigma_3)$, which is close to 0 at Mojave but close to 1 at San Gorgonio and Carrizo Plains. One interpretation of this variation is that the magnitude of both horizontal stresses is higher on the Mojave section than elsewhere on the San Andreas fault.

S11C-10 1130H

SEISMICITY AND FAULT KINEMATICS ALONG THE BRAWLEY SEISMIC ZONE AND ADJACENT REGIONS

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The Brawley Seismic Zone (BSZ) is the most active section of the San Andreas fault system in southern California. It is defined by a broad band of earthquakes that trends just west of north and connects the southern San Andreas to the Imperial fault. The high rate of microearthquake activity, combined with the shallow nature of the seismicity, the high areal heat flow, the lack of known large (M>6) earthquakes, and the orientation of the fault zone relative to the plate motion vector suggest that the BSZ should be dominated by extensional tectonics. Detailed analysis of the microearthquake data from the CIT-USGS catalog reveals, however, that north of the surface rupture involved in the 1979 Imperial Valley earthquake, the BSZ is not a single simple fault, but is composed of a complicated series of nearly-orthogonal *en echelon* northeast striking left-lateral faults that intersect other fault segments striking north or north-west. Very few of the earthquake focal mechanisms examined could be interpreted as pure normal fault solutions. Instead, the predominant style of seismic deformation is strike-slip or oblique strike-slip. Some earthquakes even exhibit focal mechanisms with a large component of reverse faulting. These events are generally located at block corners where faults intersect and could be the result of rotations induced by regional shear. Other earthquake hypocenters define a nearly-vertical northeast-striking planar feature that parallels the southern end of the Salton Sea and connects the Superstition Hills fault zone with the BSZ. Motion along this transverse structure is also left-lateral and may be accommodating relative slip between the two major fault zones as they converge at the head of Imperial Valley. Such secondary structures may control the distribution of slip between major wrench faults in California, as demonstrated by the occurrence of triggered slip on the Superstition Hills fault after the 1979 event and the occurrence of a large (M_L=5.5) earthquake on the BSZ 10 hours after the 1942 Superstition Hills earthquake (M_L=6.5).

S11C-11 1145H

QUIESCENCE OF THE SOUTHERN SAN ANDREAS FAULT AND ADJACENT SECONDARY SEISMICITY

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The southern San Andreas fault (SAF) in the area from the Pinto Mountains to Bombay Beach (Salton Sea) is nearly quiescent at the microearthquake level. The closest seismicity is located 3-5 km NE of the fault. *The most active region is about* 20 km wide and extends from as far north as the Pinto Mountain fault to as far south as the Mecca Hills. Relocation of earthquakes using only stations NE of the SAF and proximal to the activity does not seriously affect epicentral locations, suggesting that the observed offset of epicenters from the SAF is not an artifact of velocity inhomogeneity. Many of the earthquakes that occur within this region can be ascribed to structures striking NE and conjugate to the SAF. Focal mechanisms of earthquakes between 1976 and 1985 were examined. Events with essentially common focal mechanisms were found to define linear trends parallel to nodal planes. Structures thus defined are consistent with a NNE axis of maximum compression, in contrast to generally N-S P axes determined in the southern Salton Trough and central Transverse Ranges. Three large blocks are bounded by the Pinto Mountain, Blue Cut, Chiriaco and San Andreas faults. The western portions of these blocks are currently active in response to accumulating elastic strain across a locked SAF. None of the major E-W striking surface faults are seismically active, however, microearthquakes define E-W *en echelon* structures in the northern block. A $M_L \approx 4$ event in a previously quiescent locality NW of the 1947 Morongo Valley earthquake occurred in January 1985. This is the largest event to occur in the study area in the period from 1976 to 1985. A second set of 5 events with $3 < M_L < 4$ occurred 14 km to the SE during January. These events fall on a NE striking lineament defined by earlier earthquakes. The asymmetric concentration of activity in the north portion of the study area suggests that this area has localized higher stress. Alternatively, the closely spaced active structures are uniquely sensitive to the level of stress on the SAF.

Local Earthquake Studies

Room 308/310 Mon PM
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S12A-01 1330H

Scaling Laws and Source-Time Functions of Small Earthquakes

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Far-field P and S waves are used to examine the scaling relation between computed moment, observed source-time function, and source dimension. Aftershocks (M<3.5) of the San Fernando earthquake recorded at six stations with hypocentral distances of 3 to 30 km are studied.

Pulse widths have a minimum, and corner frequencies have a maximum value for events below a threshold of 10^{21} dyne-cm. The limiting values are different at each of the six recording sites and indicate that they are a result of low pass filtering caused by structure (fmax). The source is effectively impulsive and there is no scaling relation between corner frequency and source dimension. Waveforms and spectra scale linearly in amplitude only with moment.

Events with moment above the threshold are deconvolved with smaller events, used as empirical Green's functions, to obtain actual source time functions. The rupture durations are used to model observed seismograms. The stress drop (100 bars) and source dimensions used fit conventional scaling relations.

An asperity for a magnitude 3.5 event is observed. It appears to be a result of an acceleration of rupture. Forward modeling with a synthetic slip function indicates that the asperity contributes *significant high frequency content to the seismograms.*

S12A-02 1345H

Scaling of M_L, m_b, and M_S to the Seismic Spectrum

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Earthquakes with similar short-period amplitude, i.e., similar M_L or m_b, can show large differences in long-period amplitude, i.e. M_S. These differences may arise from variations in path propagation characteristics, in source depth, and in source parameters. We have examined emperical relationships between M_L, m_b, and M_S, and the seismic spectrum observed at near distance, for events of the Mammoth Lakes earthquake sequence. These events are ideally suited for such a study since propogaion characteristics to regional and teleseismic stations are essentially identical, relative focal depths are well constrained, and the events cover a large range of magnitudes. Average spectra were determined for the study events from local strong-motion and digital recordings. The magnitude parameters were converted to spectral levels at the frequencies at which they were determined, for direct comparison with the observed spectra. In almost all cases, the spectra are consistent with the ω^{2} model of Brune (1970), and the magnitude estimates are consistent with their position on the seismic spectra. For three events of similar depth but varying by one unit of magnitude, the magnitude parameters scale simply with the source size inferred from the corner frequency. Thus in contrast with many events associated with the San Andreas system, Mammoth Lakes events do not show a spectral rise to long-period and an anomalously high $M_S/(M_L$ or $m_b)$ suggesting that the seismic radiation is the result of a relatively simple faulting process.

S12A-03 1400H

Instrumental Distortion of m_{bLg} Magnitudes

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A number of seismic networks have adopted the m_{bLg} scale proposed by Nuttli in 1973 as a measure of source size. It has been pointed out by Herrman and Kijko (1983) that application of this scale to seismograms recorded on instruments other than the WWSSN short-period seismograph can lead to biased magnitude estimates.

The Earth Physics Branch has used m_{bLg} as a measurement of source size for events in Eastern Canada for many years, with amplitudes and periods being measured mostly from instruments whose response is flat to velocity from 1 to 10 Hz. It is shown, by simulating WWSSN seismograms from those recorded on these high-frequency seismometers, that the latter give

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