TWO TYPES OF MICROSEISMS*

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In general, microseisms are a nuisance. It is now quite widely agreed that microseisms are channel waves, similar in nature to the *Lg* and *Rg* waves. It is not at all unusual to observe microseisms which have traveled over distances of continental proportions. In order to determine the direction from which the microseisms come and to investigate in more detail the characteristics of microseismic disturbances, we established a tri-partite system on Mount Palomar. The array consisted of three stations, located at the vertices of a triangle, which was about 2,500 feet on a side. Two Benioff strain seismographs and one Benioff vertical pendulum seismograph were installed in a strain vault at one location. One vertical pendulum seismograph was installed at a second location, and two horizontal and one vertical pendulum seismographs were installed at a third location. Portions of the records which were obtained on two consecutive days are included in Figure 1. The direction of approach can be calculated from the displacement between the peaks on the three verticals. These observations indicated that the waves practically always come from the coast. The direction of approach generally lies between north-northwest and south-southwest. The horizontal pendulum traces in record (*a*) are parallel. This indicates that the horizontal motion is in a northeast-southwest direction and *vice versa*. Everything on record (*a*) points to a Rayleigh type motion. Shear waves predominate on record (*b*). The fact that the horizontal pendulums are opposed to each other indicates that the motion is in a northwest-southeast direction. The horizontal component of displacement is, therefore, perpendicular to the direction of propagation. The sum of strain components is practically zero, as it should be for a horizontally polarized shear wave. The vertical pendulums show some small motions. This is to be expected, since some Rayleigh type motion is always present. Both of these waves are characterized by six-second periods, but usually the Rayleigh type motion predominates.

Among the many other types of microseisms which are observed are the two-second microseisms with wavelengths between about one-third and one-half the wavelength of the six-second waves and practically the same velocity. These waves originate near the coast—probably on the continental shelf. It is generally believed that they are generated by turbulent air masses over the continental shelf. The horizontal pendulum and the horizontal strain seismographs show practically only the six-second waves and very little of the shorter waves. We were puzzled by the fact that here we had a wave which traveled with the Rayleigh wave velocity but possessed mainly a vertical component. Fortunately, Dr. Press could give us the probable solution. Drs. Ewing and Press had demonstrated theoretically that

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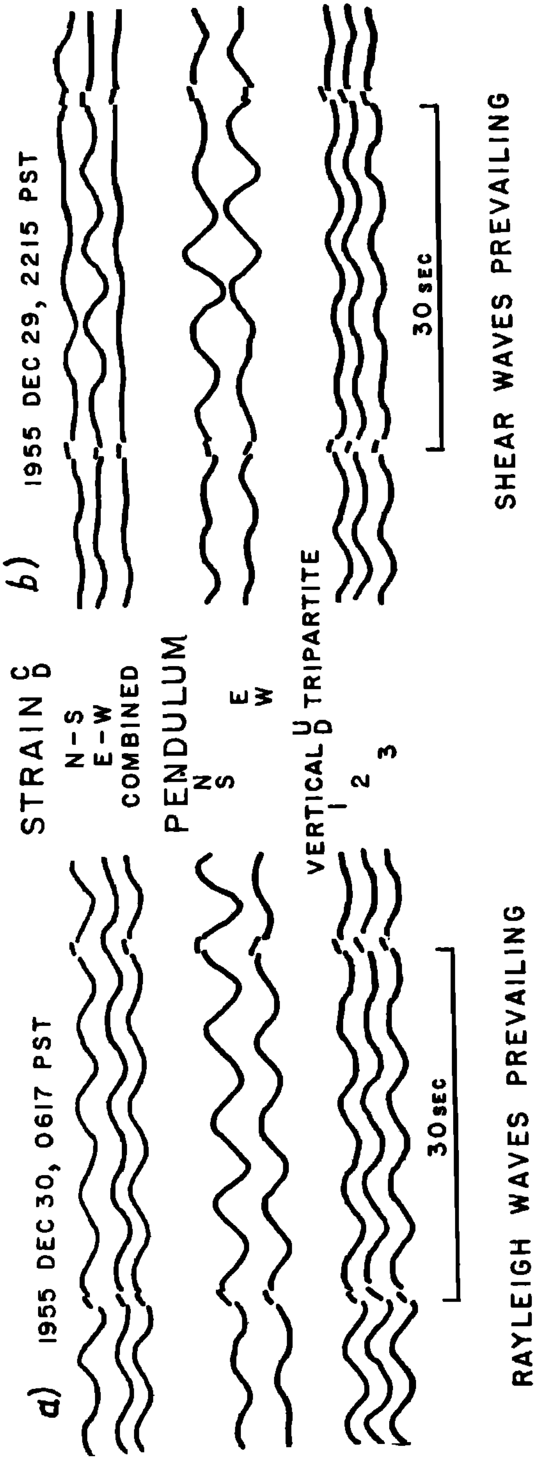

Fig. 1—Microseisms observed December 29 and 30, 1955

the higher mode Rayleigh waves could show exactly this behavior. Thus far, very little is known about these waves. Whereas the six-second waves can propagate across distances of continental proportions, the two-second waves are never observed very far inland. Our observations show that they do not propagate beyond about ten wavelengths. At the present time, I do not know whether this characteristic has something to do with the mechanism of propagation or with the structure of California.

DISCUSSION

L. Knopoff: In some of our model experiments, we have found that the Rayleigh waves suffer a severe attenuation when the topography is about a quarter wavelength high. The two-second waves have a quarter wavelength of about 1,500 meters. It is noteworthy that this is about the height of the transverse ranges.

B. Gutenberg: There are instances where the source is in the neighborhood of Pasadena and yet a strong decrease in the amplitude of these waves is observed in Riverside. We know that in this area the channel is very irregular and that, while this irregularity may not effect the six-second waves, it might have an appreciable effect on the two-second waves.