ANALYSIS OF THE 1973-74 AÇORES EARTHQUAKES

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In October 1973 - February 1974 the Pico and Faial Islands (Açores) were hit by a seismic swarm related to volvanic activity. Damage observed on rural dwellings is reported with brief comments on problems relating to fatigue, in designing against a seismic swarm. The recorded accelerograms are analyzed in order to identify the main characteristics of the ground motion. Response spectra and power spectral density of acceleration are presented and the near epicentral character of the records is highlighted.

OBSERVED DAMAGE

The Açores Islands, situated in the mid Atlantic rift, have several times been hit by earthquakes of tectonic or volcanic origin. In October 1973 - February 1974 a seismic swarm centered on Pico Island (Fig. 1) caused several hundred earthquakes, with Richter magnitude ranging up to 5, and maximum Mercalli intensity up to 7.8

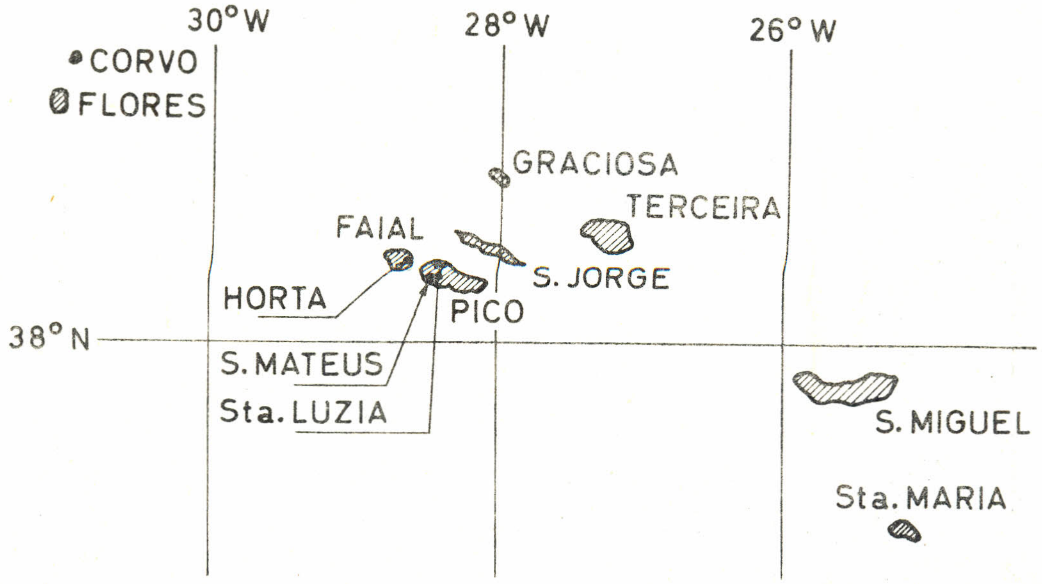

FIG. 1 — Açores Islands

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Those earthquakes were mainly caused by volcanic activity, but some may also have been of tectonic origin.

The buildings on Pico Island are mainly rural dwellings, often of poor masonry construction. Reported damage were 176 houses collapsed, 592 needing repairs and 1261 showing minor damage. The St. Mateus church was havily damaged, but the schools, when of recent construction, presented only little damage.

The effects of the earthquakes were also severely felt on nearby Fainal Island, where, in Horta, some five hundred houses were damaged. The concentration of damage in Conceição and Flamengos buroughs indicates some soil amplification phenomena.

It must be noted that a seismic swarm is a very different situation from the usual one in earthquake engineering where ruin is usually caused in a low-cycle fatigue context. The long time duration of a swarm, and the sometimes hour-long ground vibration may give rise to «true» fatigue problems.

ANALYSIS OF RECORDED GROUND MOTION

The progressive character of the seismic swarm made it possible to set up a field monitoring station, which recorded the major shocks. These events occurred on 18 th and 23th November and on 11th December. The first two were recorded in S. Mateus, the last in Santa Luzia. The N.S. component of the 11th December earthquake was not recorded.

The accelerograms were processed at LNEC according to standard techniques, and are presented in fig. 2. Maximum accelerations, velocities and displacements are tabulated in Table I.

Table I — Maximum Values of Ground Motion

Event		Maximum Acceleration (cm/sec.^{2})	Maximum Velocity (cm/sec.)	Maximum Displacement (cm)
18th November	Vert	29.3	0.91	0.084
	NS	79.6	3.43	0.22
	EW	84.2	4.17	0.29
23th November	Vert	194	5.35	0.23
	NS	273	12.8	0.56
	EW	212	10.7	0.64
11th December	Vert	221	12.6	0.96
	EW	101	4.86	0.49

The response spectra are presented in fig. 3 to 10 and some power spectral density of acceleration in fig. 11 to 14. Owing to the near epicentral character of the ground motion these spectra have a substancially high frequency content ($\geq$ 5Hz).

REFERENCES

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Machado, F.; Trepa, N.V.; Serin, C. and Nunes, J.C. : 1975, Crise Sísmica do Pico (Açores) Nov. 1973 Comunicações dos Serviços Geológicos de Portugal.

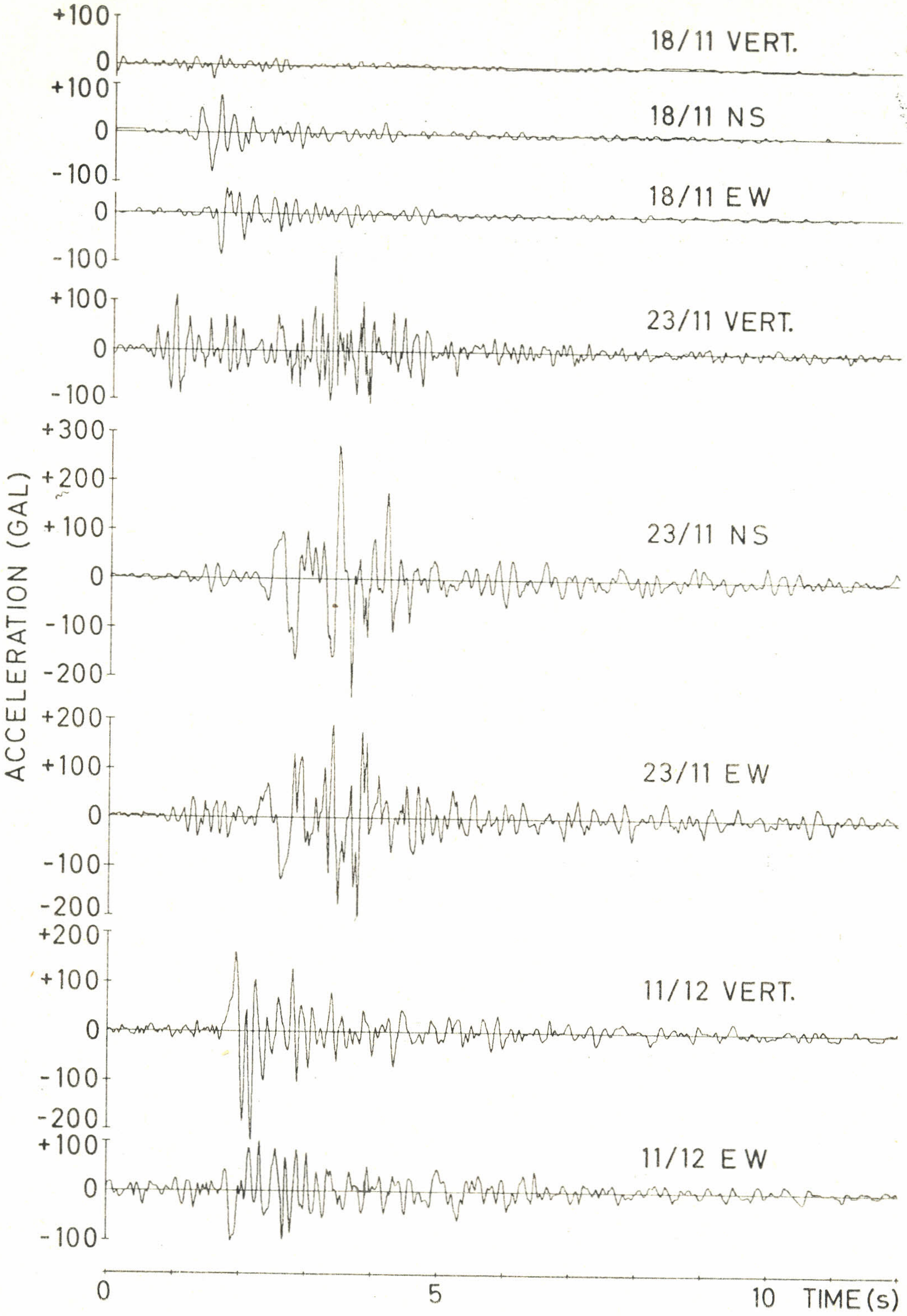

FIG. 2 - ACCELEROGRAMS OF 18 NOV., 23 NOV. AND 11 DEC.

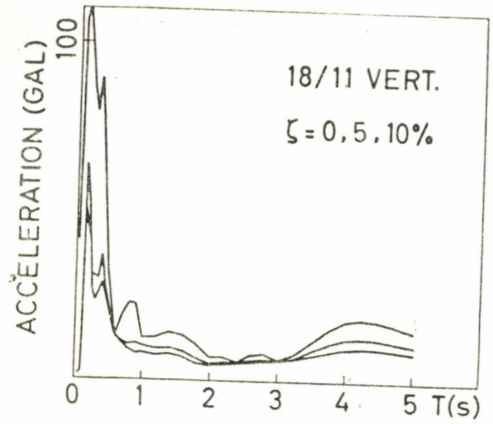

FIG. 3 - RESPONSE SPECTRA

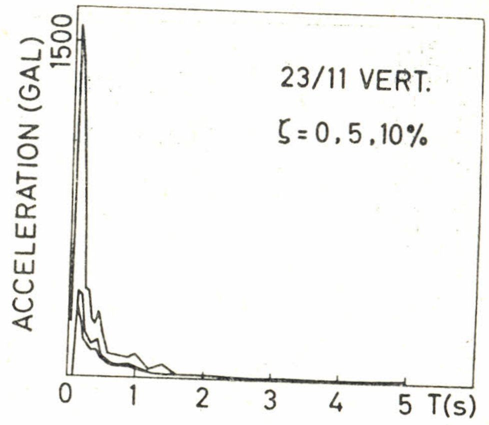

FIG. 4 - RESPONSE SPECTRA

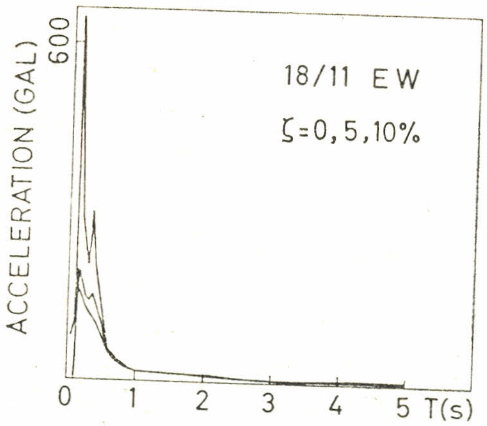

FIG. 5 - RESPONSE SPECTRA

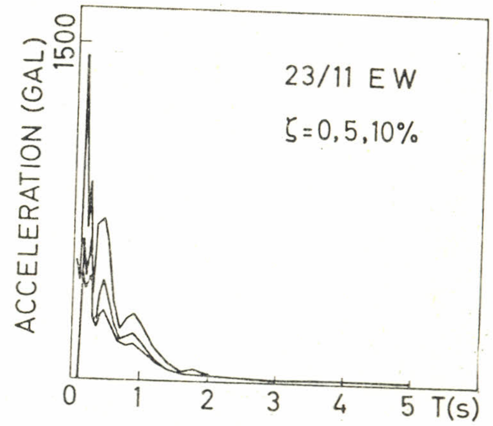

FIG. 6 - RESPONSE SPECTRA

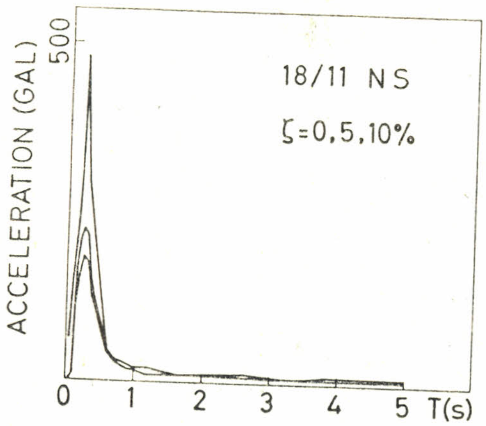

FIG. 7 - RESPONSE SPECTRA

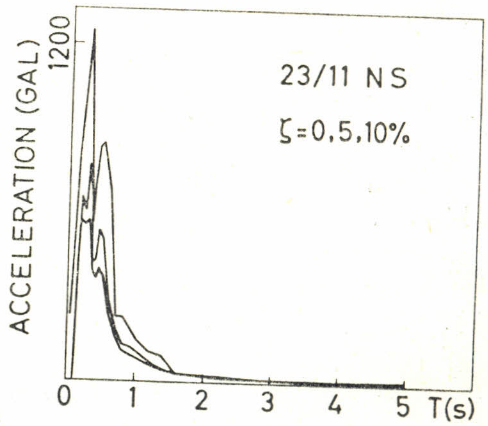

FIG. 8 - RESPONSE SPECTRA

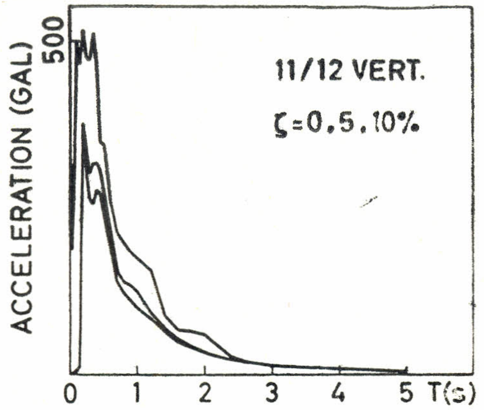

FIG. 9 - RESPONSE SPECTRA

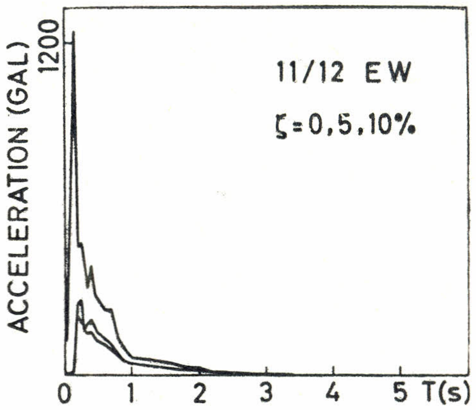

FIG. 10 - RESPONSE SPECTRA

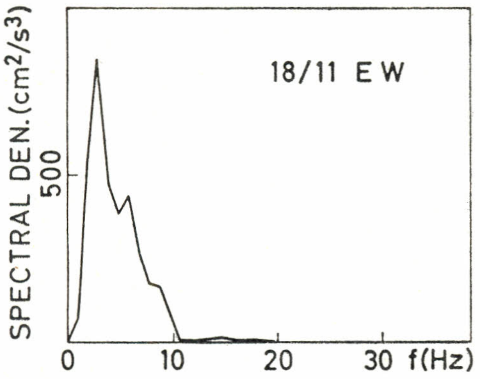

FIG. 11 - POWER SPECTRUM

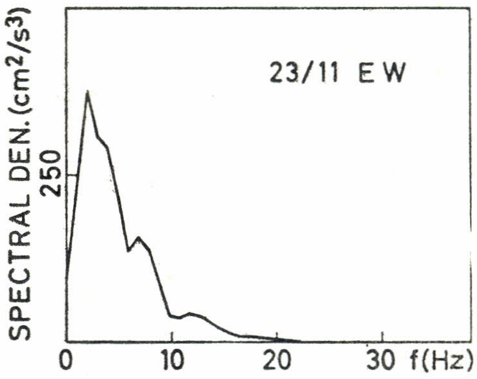

FIG. 12 - POWER SPECTRUM

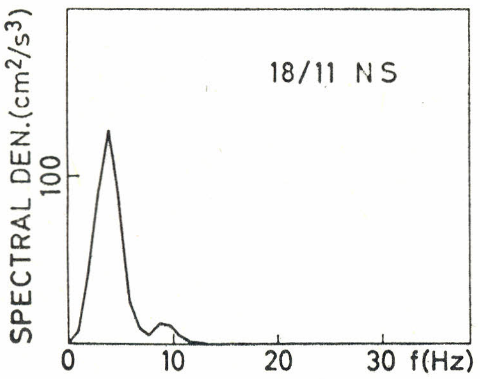

FIG. 13 - POWER SPECTRUM

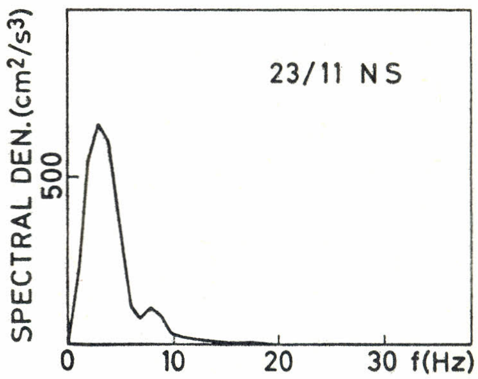

FIG. 14 - POWER SPECTRUM