

DISCUSSION

MICROSEISMS

I HAVE JUST READ (April 6, 1937) the latest paper "On Microseisms" by Dr. Gutenberg, just received.¹ You understand that interests me, but I am sorry to see how many things that I have already said are not quoted.

First. Every cyclone causes these groups of microseisms. If the cyclone can live and continue to exist over land *it must show* the groups. So do the extratropical depressions crossing our southwest China east-northeast.

If the cyclone over land *cannot exist* (the typhoon), the groups diminish and disappear (*although outside over the rocky coast* the surf continues, as we know from lighthouse reports for over thirty years!).

The thermodynamics of an extratropical depression show that the energy is caused by gravity (cold air enveloping warm air). As gravity exists also over land, the cyclone can move over land and cause microseisms in groups.

In a typhoon or tropical cyclone, the energy is derived from the *heat* liberated by condensation; gravity *is not* the cause of this energy. So, if the supply of *damp* air is shut off, the condensation will cease and the typhoon will die; this happens when it enters the continental area.

Second. The theory of these microseisms *must explain* also the *period* of these motions (cf. my *Note de Séismologie no. 12*, now in press). My "pumping" period explains that. The breaking on the coast does not explain it.

Third. If the waves have the required energy for causing these microseisms, it is clear that the disturbance which causes the waves *must* have the required energy; otherwise no reasoning on causality is valid!

Fourth. We have here in the Far East monsoon high seas with strong and long lasting gales (four to five days continuous force, 7 to 11 Beaufort scale) breaking on rocky shores—the same where typhoons strike. Why are no groups registered in these types of rough weather?—just as Dr. Banerji has found in India, where there is also rough monsoon or anticyclonic weather.

All these points seem to be overlooked, although they are essential and I have explained them many times.

I have now also the evidence of sea captains that sometimes the "pumping" in typhoons stops and, although they report hurricane winds with very high seas, *no swell* is experienced. This is the explanation of the fact that sometimes with a typhoon or cyclone close to the Seismological Station no microseisms in groups are registered.

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¹ B. Gutenberg, "On Microseisms," *Bull. Seism. Soc. Am.*, 26:111-117 (April, 1936).

DISCUSSION (*Concluded*)

In reply to the suggestions of Father Gherzi, I wish to state:

First. Not every cyclone causes these groups of microseisms.

One of the main reasons for the publishing of my paper "On Microseisms" was to give unimpeachable proof of this fact as far as North America is concerned. For Europe similar cases have been published in the earlier literature.

Second. My theory of these microseisms explains the periods of these motions. (Cf. page 113 of my paper "On Microseisms," last paragraph.)

Third. There is no doubt that the cyclones have the energy required. The problem, however, is how this energy is transferred to the ground and I have given an estimate concerning the energy involved in the surf, which indicates that it is of the right order.

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