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RELATIVE SEISMIC ENERGY RELEASED IN SOUTH PACIFIC AREA

R. LOUAT [1]

Various seismological studies have been in--vestigated in the South West Pacific area. BARAZANGI et al 1969, DENHAM 1969, ISACKS et al 1968, JOHNSON and MOLNAR 1972, MITRONOVAS et al 1969, PASCAL 1974, SYKES et al 1969. The distribution of earthquakes in a narrow belt separating the Pacific and Australian plates is the first evidence. Further inves--tigations and especially studies of focal mechanisms of shallow eartquakes indicate the convergence of the two lithospheric pla--tes. In this study we will use mechanisms and their interpretations compiled by JOHNSON and MOLNAR. The existence of an inter

The energy release of an individual earth--quake is obtained from the body wave average magnitude by the formula of RICHTER

$\log E = 5.8 + 2.4m$ E en ergs

Knowing this formula, we have divided the South West Pacific area in unity squares. The side of these squares is a quarter of degree. In each square we have cumulated the energy released by shallow earthquakes from 1961 to 1973. Informations about earthquakes come from I.S.C. bulletins. The latitude and the longitude of epicenters give us the indices of squares affected by the earthqua--ke. we add the energy computed by the Rich-

released is equivalent to an eartquake in the range of magnitude 6.1, 5.5, the third kind of square is for the energy greater than an earthquake of magnitude 4.8 and smaller than an earthquake of magnitude 5.5. The results will be explained considering four regions : the New Guinea, and Solomon islands, the New Hebrides, the Tonga arc, the Fidji Plateau.

New Guinea - Solomon islands region (fig. 1)

This region is one of the most complex in the South West Pacific area. JOHNSON and MOLNAR propose the existence of at least three additional small plates The north Bis--marck plate, the south Bismarck plate and the Salomon sea plate. The boundary between north Bismarck and south Bismarck plate is the east west trending belt of activity in the top of the figure. Several focal mecha--nisms indicate a left lateral strike slip motion. We can see the seismic belt is narrow and the energy release quite weak. The boun--dary between south Bismarck plate and Solomon sea plate is very seismic on a large surface. JOHNSON and MOLNAR have found eleven focal mechanisms which indicate that the Solomon sea floor is underthrusting the New Britain arc in NW-W direction. Ten other mechanisms show that the Solomon sea floor underthrust the Solomon arc in a NE direction The release of energy is weaker fot the se--cond arc than for the first. An other line of energy release is seen south of this belt. One focal mechanism after JOHNSON and MOLNAR indicates a normal faulting. ISACKS et al (1968), STAUDER (1968) interpret this kind mechanisms indicate the direction of relative motion between the two main plates directed N-E, this direction is intermediate between the strike and the perpendicular axe of boundary explaining the fact that the energy release is quite high, the seismic activity being smaller than in the New Britain region. We can see when the axe of motion is nearer to the perpendicular axis of the boundary the energy release is greater. We consider that property as a structural property of of subduction zone.

New Hebrides Islands (fig. 2)

The seismicity of this region has been investigated by PASCAL (1974).Most of focal mechanisms from shallow earthquakes show the underthrusting of the Australian plate beneath the Pacific plate. The north of this structu--re is characterized by the lack of high energy release excepted on the east of the trench where a second line of stress exists which coincides with the strong curvature of the boundary between the two plates. In the middle of the arc, the energy released is greater, maximum stress is found at about fourty kilometers on the east of the trench, farther to the east, earthquakes are not linked with the Benioff zone and are located on the Pacific plate. On the rear of the arc a line of weaker seismicity correlates in space extensional throughs, DUBOIS et al 1974. At the southern end of the New Hebrides where the trench axis bends towards east, focal mechanisms give a northly underthrus--ting of the Australian plate, we can see

plates, as a local spreading zone on Pacific plate or faults on Australian plate.

Tonga islands (fig. 3)

The focal mechanisms of shallow earthquakes in the Tonga arc were studied by ISACKS et al. 1969. Shallow seismicity reflected two kinds of faulting. The underthrusting of Pacific floor under the Tonga-Kermadec is--lands in a westward direction on a shallow dipping fault plane. On the northern end of yhe arc, focal mechanisms show a tearing of the Pacific plate between the sufircial part in the north and a downgoing motion of the part which thrusts under the Tonga arc. We can see too the sharp cut off in the energy release when we are going towards the west. South, along the Tonga arc, we can see three lines of energy release. The first on the east caused by stresses within the Pacific plate. Some authors call those events "very unusual", for us this line of energy release characterizes a subduction zone as we have seen previously in the New Guinea Solomon region. the second line of energy release, the largest and the highest, results from thrusting mechanisms, the third line of ener--gy directed west may be associated with an extensional zone on the rear of Tonga arc. In the north west of the Tonga arc the seis--mic belt striked south east to north west is interpreted by several authors as a sprea--ding zone. The quite high energy release compared with Fijian plateau allows us to assume the spreading zone to be quite old if we agree with the fact that a young expansion zone releases weak seismic energy.

Fiji Plateau (fig.4)

The region between north of Tonga arc and south of the New Hebrides arc is characteri--zed by young oceanic crust, CHASE (1971). If we consider this region like an area being a twin boundary between the Australian plate and the Pacific plate where approxima--tively twice more material than anywhere in South Pacific area sinks in the asthenosphe--re the necessity of spreading zone in Fiji plateau area is evident. In the northern end of Tonga arc, focal mechanisms show left lateral strike slip motion along an easterly striking seismic belt. As we have seen pre--viously this kind of boundary releases quite weak energy. The focal mechanisms in the south east of the New Hebrides show a strike slip faulting in the north east direction. The energy released near the 20° south parallel is difficult to interpret, a focal mechanism shows a thrusting solution in the north east direction. We suggest inner stres--ses in the Australian plate where seismic profiles show an old fracture zone. The locations of spreading centers are not well defined, three axes in northward direction can be seen, but tectonic conclusions in Fiji region need the support of further data to be consistent, epicenters being too much scattered.

Conclusion

A map of seismic energy release give us additional informations on boundaries between main plates. Thrusting zones are characterized by high energy release on three lines of stress. First line represents inner deformation of the lithospheric plate which is bended before its underthrusting, this line is the boundary whose the lithosphere no longer acts as an elastic body. The

second line represents the thrusting mecha--nism, this line marks the maximum stress between both plates, the third line is associated with exttension zone. The strike slip faulting areas represent weaker energy on a countinous narrow line. In transition zone between well defined island arcs as the Fiji plateau, epicenters are scattered, a map of energy release cannot give us location of spreading centers or line of stress.

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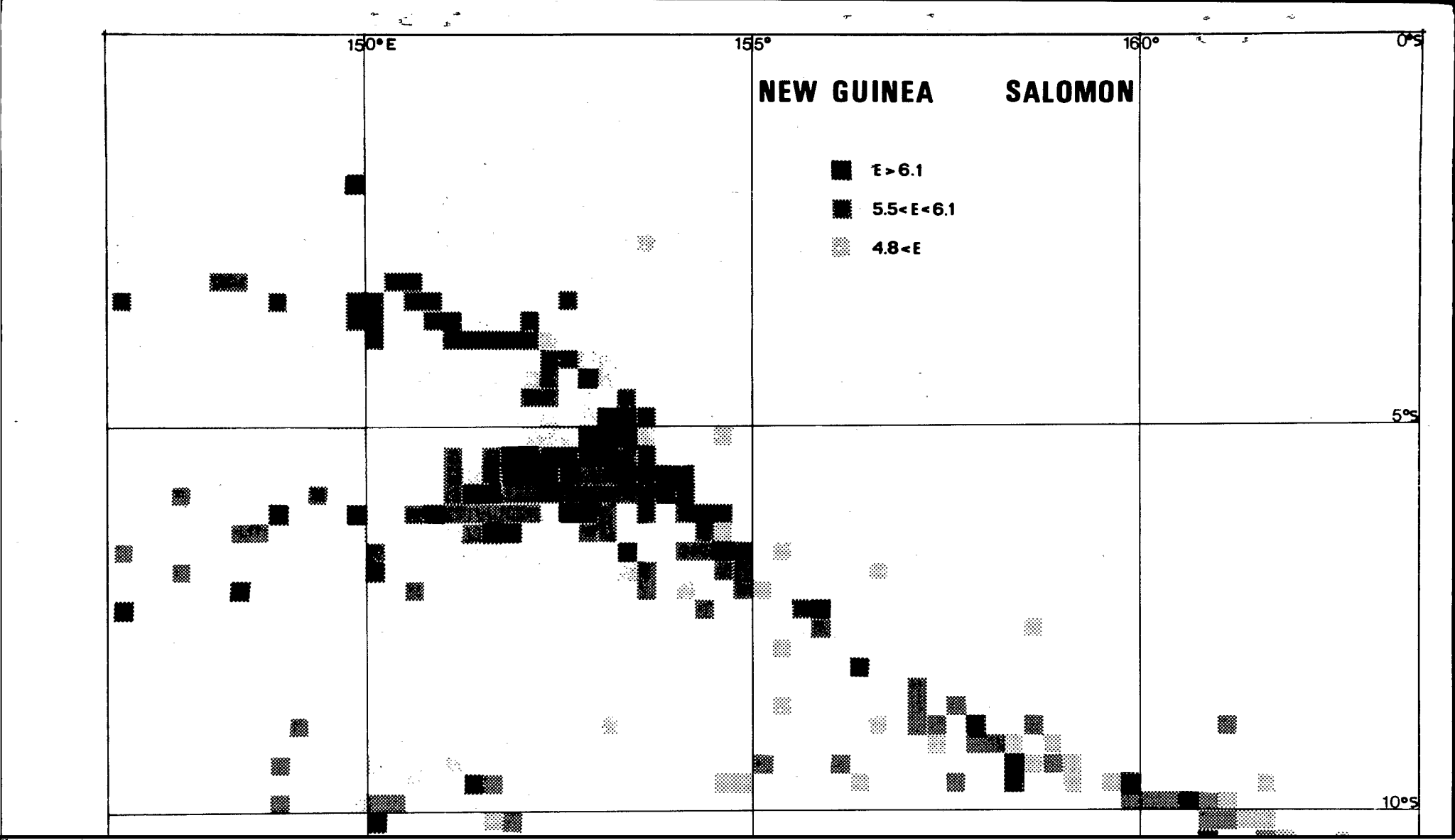
150° E
155°
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NEW GUINEA
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E>6.1
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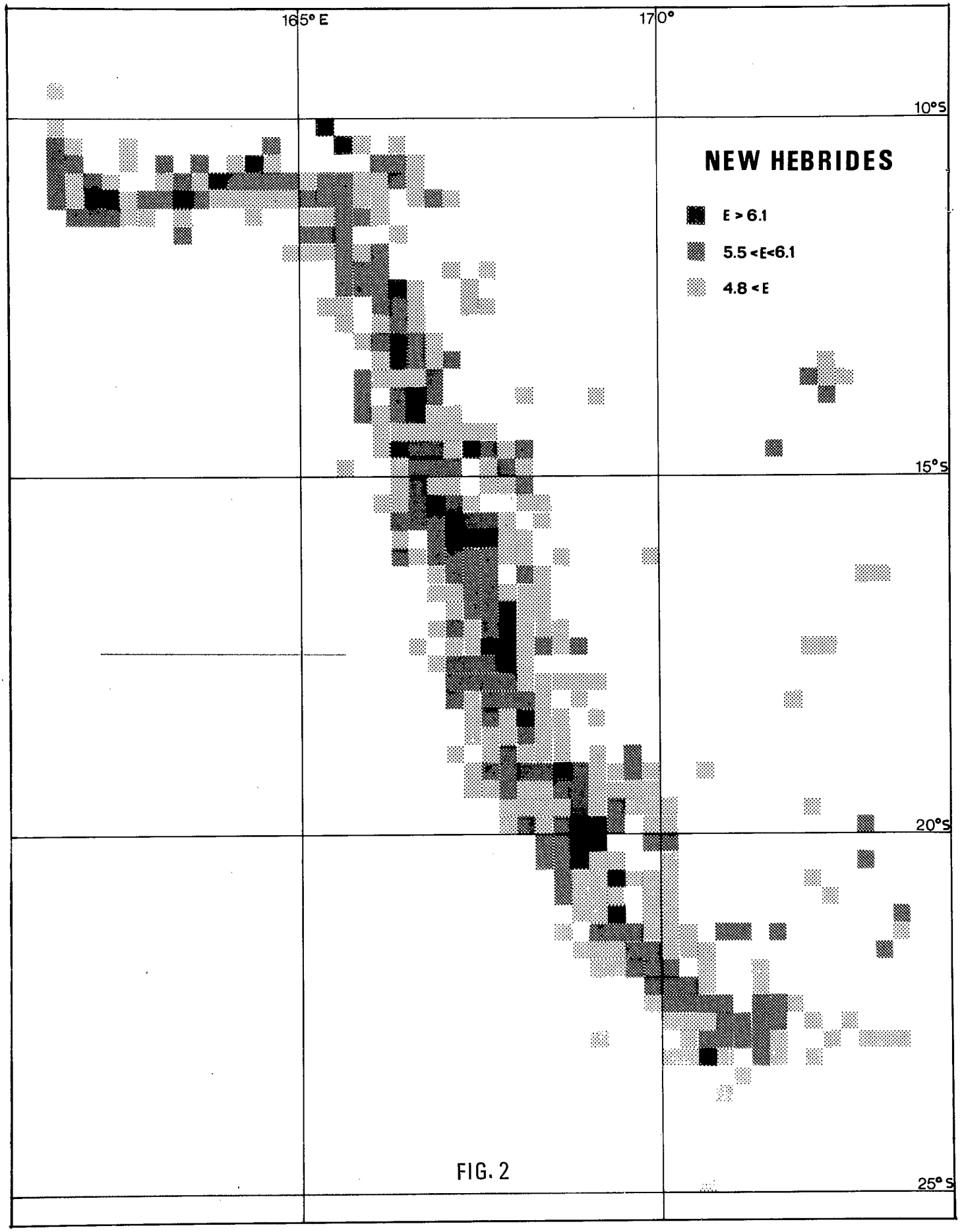
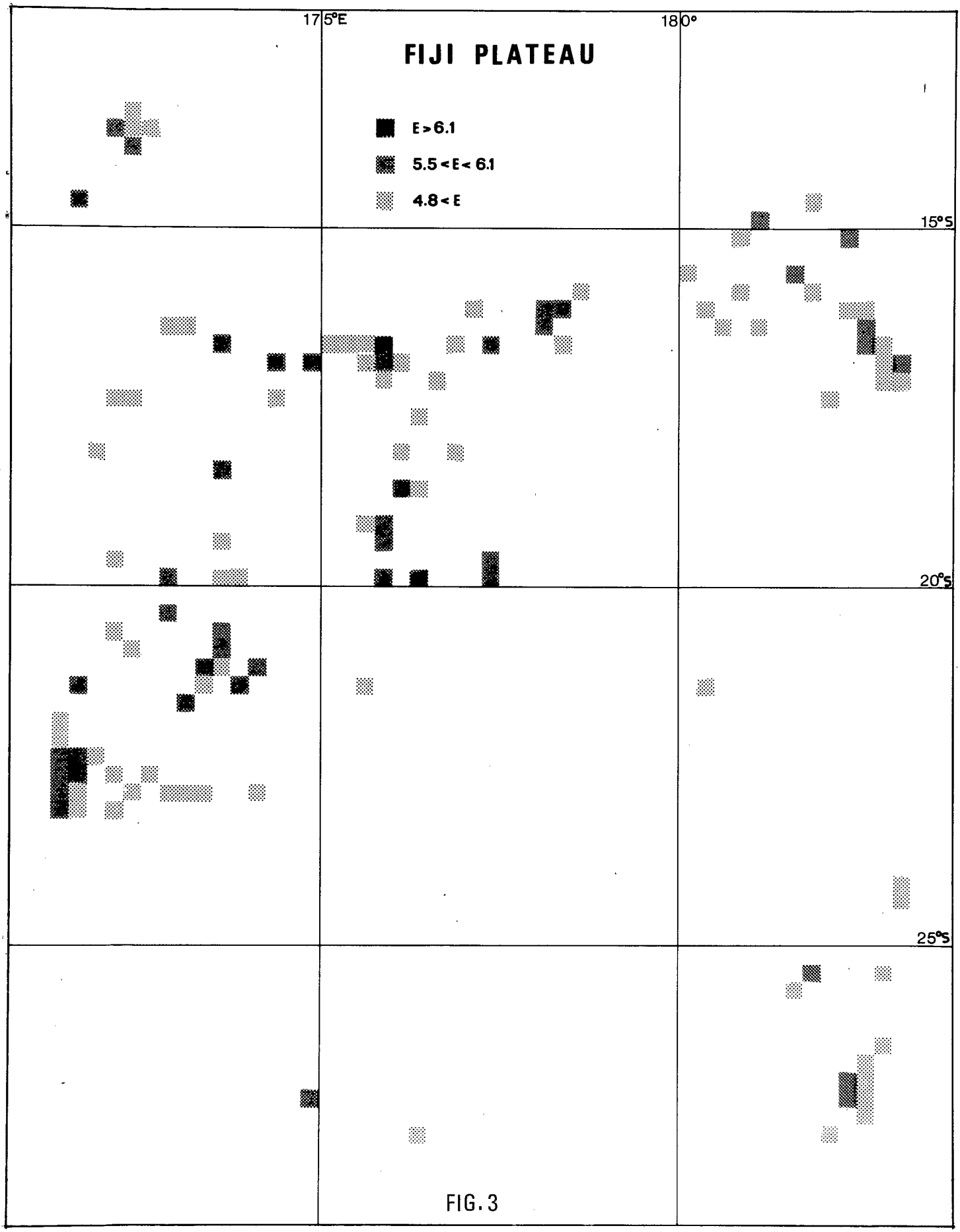


FIG. 2



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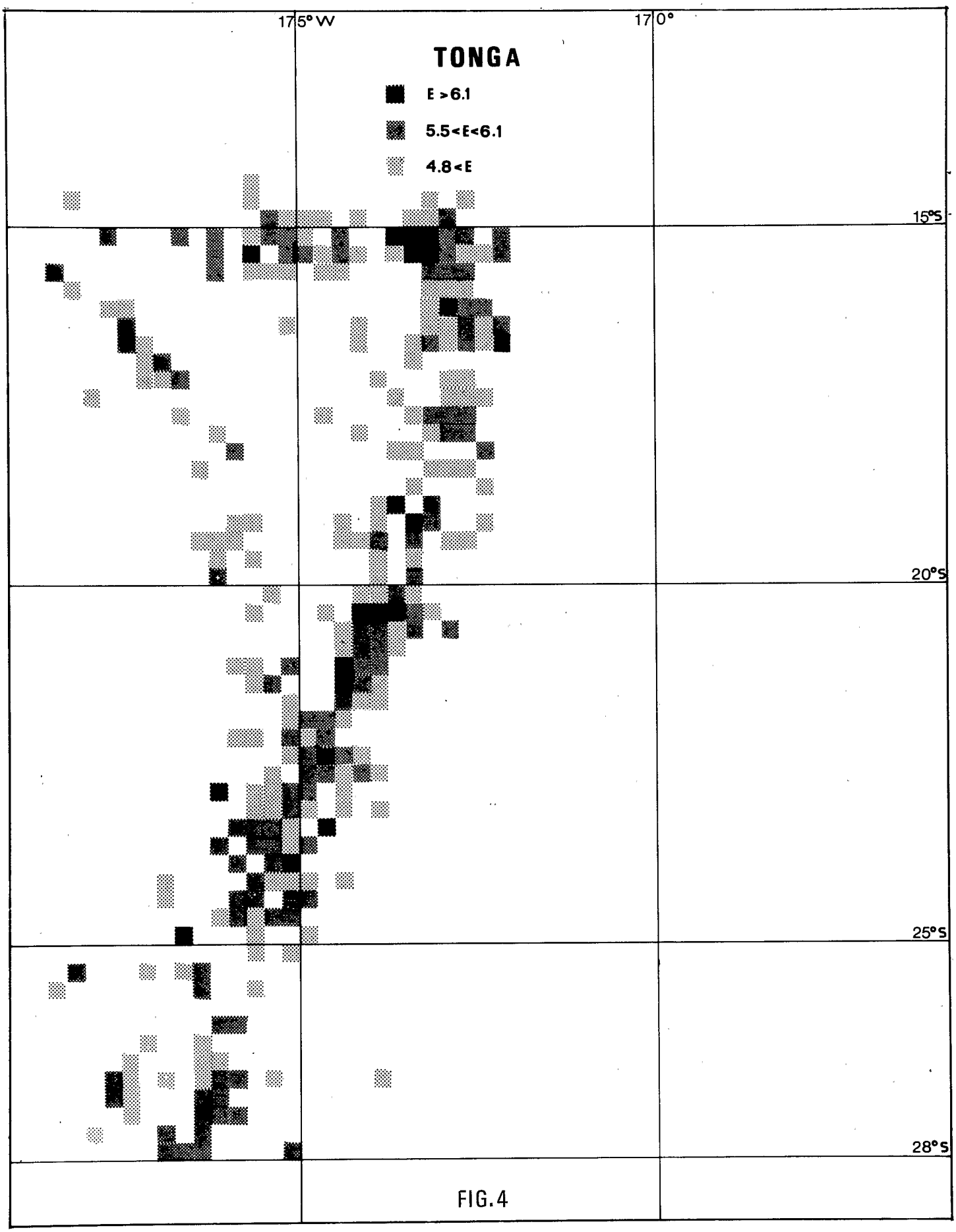
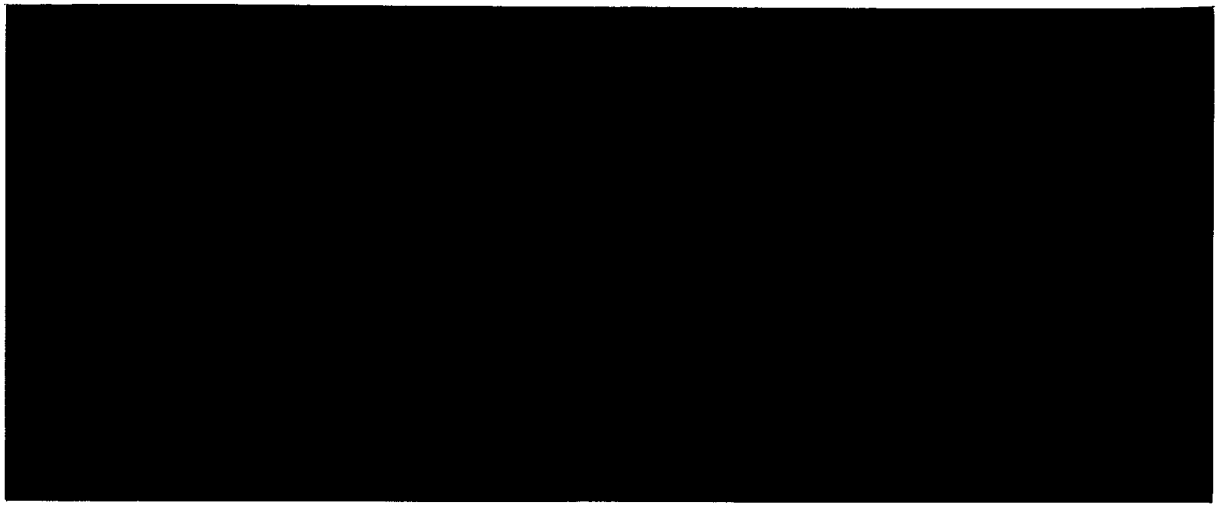


FIG.4



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