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GEOPHYSICAL VARIABLES AND BEHAVIOR: XXIII. RELATIONS BETWEEN UFO REPORTS WITHIN THE UINTA BASIN AND LOCAL SEISMICITY

M. A. PERSINGER[1] AND J. S. DERR[2]

Laurentian University *Golden, Colorado*

Summary.—A strong temporal correlation was found between the numbers of reports of UFOs (unidentified flying objects) and nearby seismic activity within the Uinta Basin for the year 1967. The numbers of UFO reports per month during this classic UFO flap were correlated 0.80 with the sum of the earthquake magnitudes per month for events within 150 km of the report area. Numbers of UFO reports were not correlated significantly with earthquake activity at distances greater than 150 km but less than 250 km away. The strongest correlation occurred between UFO reports and nearby seismic activity within the same month but not for previous or consequent months. Close scrutiny of daily shifts in epicenters and reports of UFOs indicated that they occurred when the locus of successive epicenters shifted across the area. These analyses were interpreted as support for the existence of strain fields whose movements generate natural phenomena that are reported as UFOs.

Several multivariate studies (Persinger, 1983, 1983a, 1983b, 1983c, 1984b) have indicated systematic temporal associations between reports of unidentified flying objects (UFORs) or related phenomena and the occurrence of earthquakes within a geological region. If the two phenomena are related, then the occurrence of UFORs within a smaller, restricted area should be highly correlated in time with nearby seismicity. Distant quakes, which could be used as "control measures," should not be correlated as strongly. There should also be a functional relationship between the numbers of UFORs and the magnitude of the release of earthquake energy.

Obtaining an appropriate test area for these predictions is difficult since it must contain systematic measures for both UFORs and seismic events. Whereas the measurement of seismicity is limited primarily by available instrumentation, UFOR data are subject to the vagaries of individual researchers. One candidate area is the Uinta Basin (Utah) for the year 1967. This year was associated with a classic UFO flap within a locality of approximately 2500 km^2. The data are readily accessible (Salisbury, 1974) and include reports of spherical luminous displays, metallic-looking phenomena, multicolored lights, and close encounters.

We decided to test the association between UFO phenomena and earth-

[1]Environmental Psychophysiology Lab, Department of Psychology, Sudbury, Ontario, Canada P3E 2C6.
[2]706 Partridge Circle, Golden, Colorado 80403, USA.

quakes for this area and time. In addition, we were interested in any trends that might support the tectonic strain hypothesis for UFORs (Persinger, 1976; Persinger & Lafreniere, 1977; Persinger, 1984b). This hypothesis states that a substantial portion of UFO phenomena are generated by strain fields; they are evoked by the changing stresses within the earth's crust. These fields are hypothesized to move through the earth's crust at substantial distances from imminent epicenters. Although moving strain fields have not been measured, their presence might be inferred by the timing and position of UFORs between successive epicenters.

METHOD

Data

UFORs from the Uinta Basin were taken directly from the appendix of Salisbury's *The Utah UFO Display* (1974). To determine the optimal period for analysis, a cumulative record of the numbers of days in which at least one UFOR occurred per month was calculated for the years 1965 to 1971; these years comprised the bulk (97%) of the data entries. The year 1967 was selected for analysis since it included the central, most linear portion of the record. We presumed that periods with the greatest and most consistent cumulative response rates might reflect more homogeneous processes for both the mechanisms that generated UFORs and their sampling.

A total of 36 reports were reported for 1967; all but one specified the month and day of occurrence. There were a total of 18 days in which a UFOR was recorded and maximum of 9 reports in one day. Different types of UFORs were not differentiated for the analyses. However, most of them (54%) were reports of orange-red balls. Other descriptions included multicolored lights (11%), metallic-looking disc shapes (11%), flashing lights (20%), and one "close encounter." Examples for each of the first three types were "orange-red ball. Came south over house. Saw it go up Farm Creek"; "Silver football or disc—45 ft. long, 15 ft. thick. No windows, bright distinct outline"; and "Pulsating rotating lights—green, red, amber. Shadowy round area below lights . . .", respectively.

All earthquakes that had been recorded within a radius of 250 km from Roosevelt, Utah, the most frequent locus for UFORs, for the years 1966 through 1968 were sorted from the Hypocenter Data File (HDF) of the United States Geological Survey. Magnitudes (mb) for the seismic events ranged from 3.0 to 5.3; those events for which the magnitudes were not specified were allocated $M = 3.0$. There were a total of 19, 26, and 24 earthquakes recorded for the years 1966, 1967, and 1968, respectively. The adjacent months from the years before and after 1967 were included to allow lag/lead analysis with UFORs and for comparison.

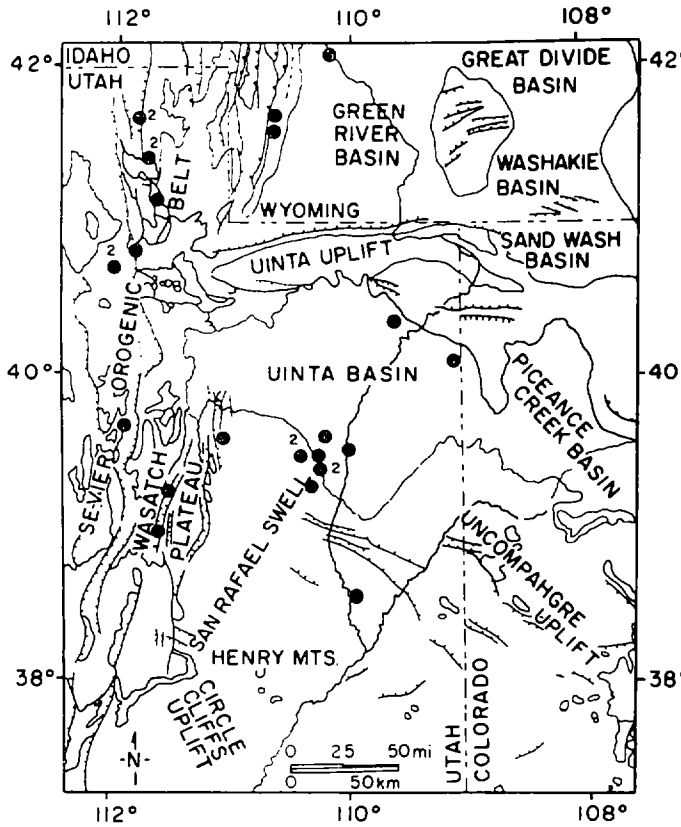

FIG. 1. Generalized geologic map of east-central Utah, southwest Wyoming and northwest Colorado, around the Uinta Basin. Dark circles indicate locations of epicenters during the year 1967. The number "2" indicates that two separate earthquakes occurred in that area; modified from Ryder, Fouch, and Elison (1976).

Major geological features of the Uinta Basin and surrounding area are shown in Fig. 1. The spatial relationship between the area within which the UFORs occurred (rectangle) and the distribution of epicenters for seismic events within 250 km of Roosevelt (indicated by the plus) is shown in Fig. 2. Each epicenter is numbered according to its temporal sequence during the year; the numbers are relevant for viewing subsequent Figs. 5 and 6. Note that one epicenter occurred within the UFOR area. This was the only instance of a recorded earthquake within the perimeter of the area for the major portion (1965-1969) of the Hicks-Salisbury data base (Salisbury, 1974).

Procedure

Two measures of UFORs were used. One included the total numbers of

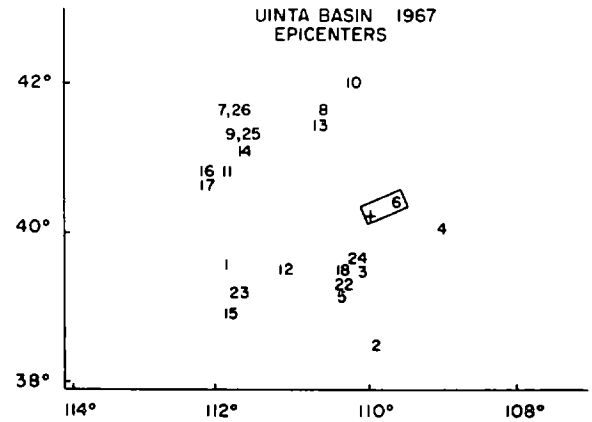

FIG. 2. Latitude (N) and longitude (W) of the detected epicenters within the Uinta Basin for the year 1967. The numbers represent the temporal sequence of the earthquakes as shown in Figs. 5 and 6. All UFORs occurred within the area delineated by the rectangle. The cross represents Roosevelt, Utah.

UFORs per month; the other included total numbers of UFOR days (days in which at least one UFOR had occurred) per month. The latter measure was considered essential to minimize excessive contribution from very active single days. The seismic measure was the sum of the magnitudes per month. Monthly increments of analyses were selected in this study on the basis of previous studies (Persinger & Derr, 1984).[3]

The seismic measures were computed for the events per month within radii of 100 km, 150 km, 200 km, and 250 km from Roosevelt, Utah. These values were not calculated for the area within a radius of 50 km from Roosevelt since only one event, in February, 1967, was recorded. All UFOR variables were lagged (LAG) from 1 to 3 mo. and all seismic variables for the various distances were lagged from 1 to 3 mo. If the UFORs were lagged before the seismic events, the operation was called "lag." If the seismic measures were lagged before the UFORs, then the operation was called "lead." This symmetrical lag/lead analysis (Persinger, 1981a) has been useful for demonstrating the specific temporal relationship between UFORs and seismic activity.

Both Pearson r and Spearman ρ (nonparametric) correlations were determined for the lag/lead combinations of UFORs and seismic activity. Spearman ρ analyses were included since the normal distribution of both UFOR and seismic data was marginal and because the size of the sample (12 mo.) was small. We assumed that similarities between the magnitudes and the directions of the two correlation coefficients would further support the reliability of the

[3]Also J. S. Derr & M. A. Persinger, Luminous phenomena and earthquakes in southern Washington. (Unpublished manuscript)

results. We also assumed that, if a representative sample of UFORs and a sufficient seismic surveillance were available for an area, then the relationship between the two should be obvious. All analyses were completed by SPSS software on a DEC 2020 System computer.

To obtain a visual appreciation for the daily sequence of events, the numbers of UFORs and seismic measures per day were graphed for the entire year. Our previously prepared analyses (Persinger, 1984a)[3] have indicated that "triggers" for UFORs are associated with enhanced geomagnetic activity, particularly if there had been a period of relative quiet during the previous days or weeks. The "triggering" effect by some geomagnetic factor presumes the presence of increasing tectonic strain as indicated by the consequent occurrence of an earthquake nearby.

Results and Discussion

Fig. 3A contains the results of the lag/lead analyses between the number of UFORs per month and the magnitude of seismic activity per month as a function of distance for the year 1967 ($n = 12$ mo.). UFORs were highly correlated ($r = 0.89, p < .001$; $\rho = 0.78, p < .001$) with the seismic activity of the same month. Seismic activity for the two months before or after UFORs were not significantly associated with their occurrence. There was a marginal ($p = .06$) tendency ($r = 0.42$; $\rho = 0.44$) for an increase in earthquake activity from the *previous* month to be associated with UFORs but only if very distant quakes (>150 km) were included in the analyses.

Fig. 3B also indicates the distance dependence of the earthquake contribution to UFORs. Since the maximum correlation between numbers of UFORs and earthquake magnitudes per month decreased for distances greater than 150 km from Roosevelt, a separate analysis was completed for only those quakes. Both Spearman ($\rho = -0.02$) and Pearson ($r = -0.13$) analyses indicated that the numbers of UFORs were not significantly ($p > .05$) correlated with the magnitudes from distant quakes during the same month. There was a total of 14 events in 6 separate months for distances >150 km compared to a total of 12 events in four separate months for distances ≤ 150 km.

The monthly stream of UFORs and seismic activity within 150 km of Roosevelt for the year 1967 is shown in Fig. 4A. The numbers refer to the total seismic events per month. As can be seen, UFORs systematically increased and decreased with both the occurrence and the magnitude of seismic displays within the region. To discern whether this trend continued into the next year, the number of UFORs (which was equal to the number of UFOR days; $n = 3$) and the sums of the earthquake ($r \leq 150$ km) magnitudes for the first 6 mo. of 1968 are also shown (Fig. 4B). The relationship was still evident. In contrast, the sums of the magnitudes from distant seismicity ($r > 150$ km)

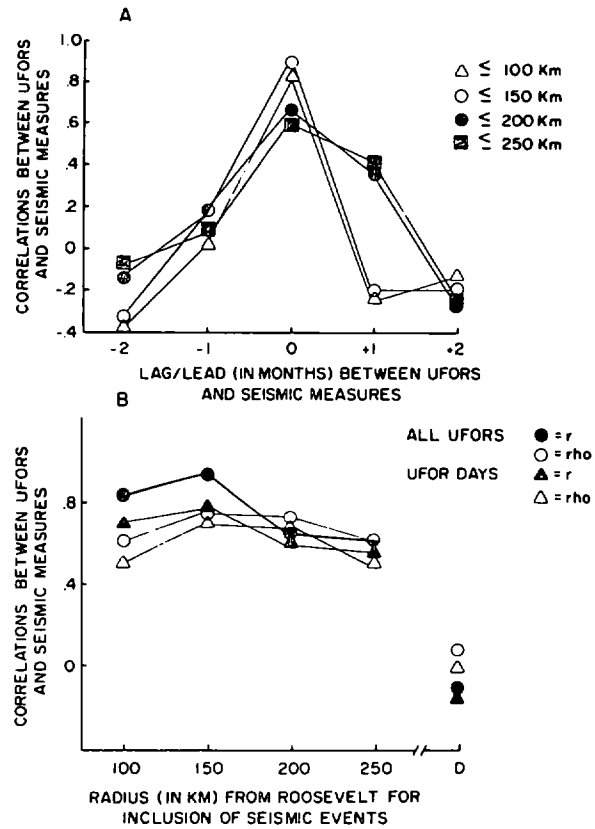

FIG. 3. (A) Pearson correlations between the numbers of UFORs and the sum of the earthquake magnitudes per month within increasing radii from Roosevelt. The lags (negative values) indicate that the UFOR data were correlated with seismic activity during the next 1 or 2 mo. The leads (positive values) indicate that the seismic data were correlated with the UFOR activity for the next 1 or 2 months. (B) Pearson and Spearman (ρ) correlations between the numbers of UFORs per month or the numbers of days in which at least one UFOR occurred during the same month and the sum of the magnitudes of seismic events per month within radii of 100, 150, 200, and 250 km of Roosevelt. The D indicates correlations between UFORs and earthquake measures for distances greater than 150 km only.

during 1967 were not systematically related with the numbers of UFORs (Fig. 4C).

To test the hypothesis that a moving strain field might have been the primary source of UFORs, their occurrence between successive shifts in epicenters can be evaluated by referring to Figs. 2, 5, and 6. UFORs occurred primarily when there was a shift in earthquake epicenters that crossed near or through the Roosevelt area. Moreover, the direction of the shift was also

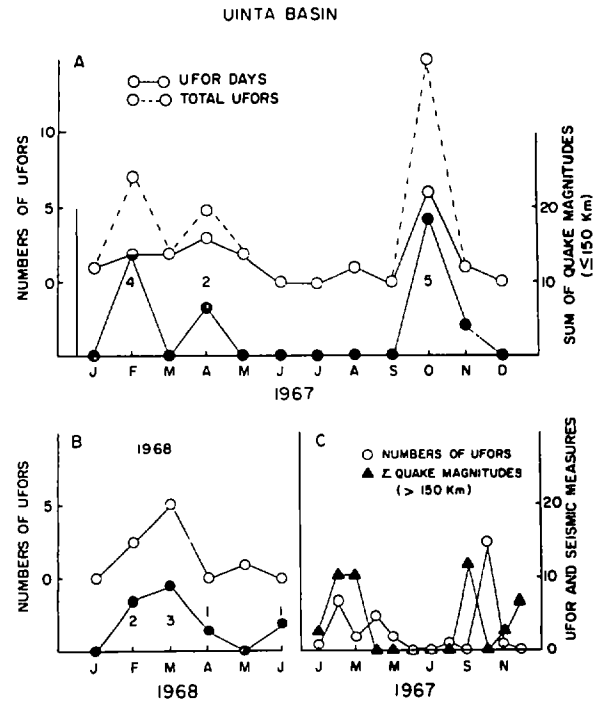

FIG. 4. (A) Monthly values for the total numbers of UFORs (open circles, dotted lines) or number of UFOR days (open circles, closed lines) and the sum of the earthquake magnitudes per month for the year 1967. The arabic numbers indicate the total separate seismic events per month. (B) Continuation of the numbers of UFORs per month and the sum of the earthquake magnitudes per month for the first six months of 1968. (C) Comparison of the total numbers of UFORs per month and the sum of the magnitudes per month for events further than 150 km but less than 250 km from Roosevelt.

related to the display of UFORs either before or after the proximal seismic events.

The major cluster of UFORs in October occurred between epicenters No. 16-17 and No. 18-22 when the strain field might have moved through the region. On the other hand, the February cluster occurred *after* the major proximal seismic event No. 6 but before event No. 7 when the strain field would have been moving through the area in the other direction. Similarly, the smaller April cluster occurred between proximal epicenters No. 12 and No. 13, as would be expected if the strain field was moving in that direction. Obviously, this metaphor is based upon the simplistic assumption that the strain field, if it existed, moved in more or less straight lines between successive epicenters.

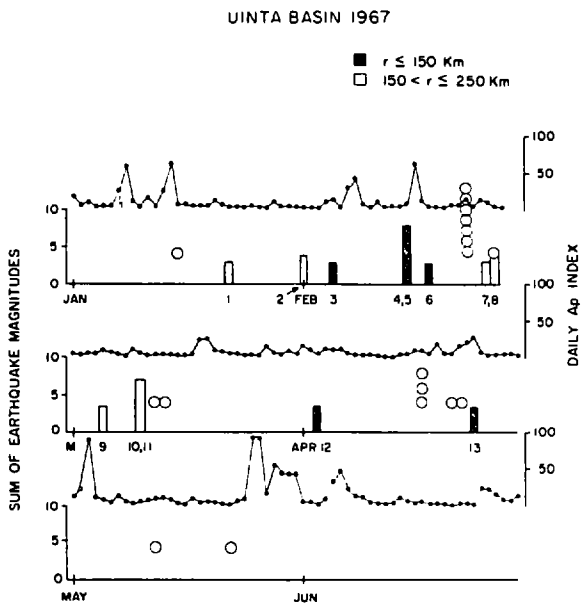

FIG. 5. Ap values (small closed circles), numbers of UFORs (open circles) and sum of the earthquake magnitudes per day for events within 150 km from Roosevelt (dark bars) and at distances greater than 150 km from January through June, 1967. The number under each seismic event refers to the position of the epicenter on Fig. 2.

The "trigger" effect from sudden increases of geomagnetic activity, particularly if there had been several days of relative quiet conditions, was less convincing than expected from previous unpublished studies. Usually UFORs tend to occur within 2 or 3 days after sudden increases in geomagnetic activity but only if the period is associated with an increase in nearby small magnitude seismic events. Very intense, sudden geomagnetic storms, defined by Ap values greater than 100, may be followed by UFORs 10 to 20 days later during the most quiet days. Unfortunately, there have been no quantitative studies to determine the relationship between the magnitude of the geomagnetic disturbance and the latency and magnitude of UFORs.

If the contribution of geomagnetic activity to UFORs requires strain within the region, as defined by increases in local seismicity, then the weak effect noted in this study may have been related to the paucity of earthquakes during this period. All of our analyses have indicated that contributions from geomagnetic variables appear to require the existence of increasing tectonic stress, as defined by seismicity, within the region. The effects of these sudden geomagnetic perturbations upon the occurrence of earthquakes within a region during periods of peak stress are not clear.

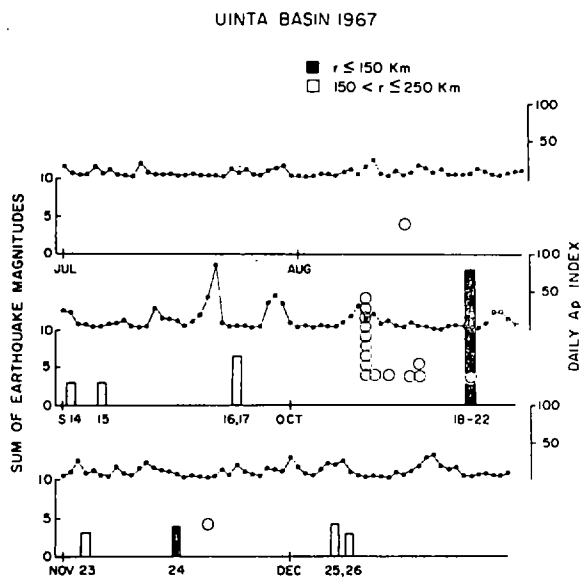

FIG. 6. Ap values (small closed circles), numbers of UFORs (open circles), and the sum of the earthquake magnitudes per day for events within 150 km from Roosevelt (dark bars) and at distances greater than 150 km from July through December, 1967. The numbers refer to the portion of the epicenters on Fig. 2.

Rutkowski (1984) has argued that many previous analyses (Persinger, 1981b, 1983d) have been limited by their data bases. Other analyses (Persinger, 1980a, 1983b, 1983c) have been criticized for the use of large increments of space and time that could have allowed the inclusion of other variables (Rutkowski, 1984). The present study indicates that a strong relationship existed between both the occurrence and the numbers of UFORs and both the occurrence and magnitude of seismic events. Whereas the UFORs were concentrated within a locus that was approximately 2500 km^2, the process involved with their occurrence included epicenters within an area that was 25 times as large. This relationship may be unique to the Uinta Basin and the specific ratios may vary in different geological locations. However, the magnitude of the areas involved reaffirms the large-scale geophysical perspective through which the phenomena of UFOs must be perceived (Persinger, 1984a).

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