

SEISMICITY AND STRUCTURE
IN THE VICINITY OF THE PROPOSED
MERAMEC PARK RESERVOIR

by

Abdul Qadir Khan, B.Sc. (Hons.) M.Sc.

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DIGEST

A USGS supplied telemetered array was established in order to monitor earthquake activity in the vicinity of the proposed Meramec Park dam. The primary purpose of the research was a pre-construction survey at the site of the proposed dam and lake in order to investigate the natural, undisturbed level of seismic activity in the area and to determine the seismic recurrence rate and the relation, if any, of micro-earthquakes to faults in the area.

The results of this study are negative as far as the 9 months duration of this experiment is concerned; no micro-earthquake activity was recorded during this period. A number of other events, however, were noted on the seismograms, which merit investigation. A sequence of events of relatively low frequency energy occurred following one of the larger mine explosions in the Pea Ridge iron mine, which is situated within the array. Characteristically, signals from nonexplosion events were quite different from those of explosion events coming from the Pea Ridge mine, though their epicentral locations were in the same area. Fourier spectral comparison of

the signals from these two kinds of events showed an amplitude maximum to occur at a period of about 10^{-1} sec in the case of the explosion, and at a period of 2×10^{-1} sec in the case of nonexplosion events. That is the explosion events have higher frequency shear energy than the nonexplosion events. A travel time study shows that the nonexplosion events are shallower than the explosion events. This introduces a possibility of the occurrence of these nonexplosion events due to displacement along fracture planes existing in the upper crust of the Pea Ridge mine area. These fractures might have developed due to instability of the prevailing local stresses caused by the large explosion of January 14, 1973.

Dispersed short-period surface wave trains from explosions of Pea Ridge mine, and some other nearby events allow a study of the surface crustal structure in the area. It is found that the thickness of the uppermost sedimentary layer varies from .1 to .2 km within the array, which is in agreement with the geological information about the thickness of the uppermost sedimentary layer.

A P wave reflection arrival is also identified. By using, T^2 vs X^2 method the depth of the reflecting horizon is estimated to be about 8 km.