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The Iranian Long Period Array (ILPA)

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Abstract. The extended range 7 elements (ER7) seismic array, ILPA, has been installed in Iran. Construction was started in the winter of 1973 as a joint undertaking of the governments of Iran and the United States of America. This array began its operation in January 1976.

Key words: Array – Iranian long period array.

Based on a request from USGS under sponsorship of the Advanced Research Projects Agency (ARPA), the United States Government proposed to Iran, in cooperation with the Institute of Geophysics, University of Tehran in November 1973 the installation of an extended range seismic array on the Iranian Plateau. The purpose of such an array was to provide data for research on seismological detection and identification problems. Field work and instrument installation were performed by Texas Instruments, Geotech, and by the Institute of Geophysics, Tehran University. USGS and Texas Instruments acts as a consultant and technical adviser for ILPA. The purpose of this paper is to inform our colleagues about the capabilities of the array, as well as the research activities which make use of the ILPA data.

ILPA is located southwest of Tehran and comprises 7 three-component wideband borehole seismometers, model 36,000 developed by Geotech. The array is circular in shape with 6 instruments forming the circle and the seventh located in the center of the array. The diameter of the array is about 60 km. The coordinates of the remote sites (Latitude φ, and Longitude λ), the distances between site number 1 in the center of the array and other 6 sites on the circle (Δ_{1-i}) and the azimuth (AZ) with respect to site number 1 and north direction (clockwise direction) are given in Table 1. The coordinates for sites and the elevations have only been estimated from the topographic maps.

The seismometers are in boreholes with depths about 100 m. One borehole seismometer system consists of a cable strain relief, stabilizer, electronics, seismo-

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Table 1

Site No.	φ Lat	λ Long	Δ_{1-i}	AZ	Elev.
1	35.41 N	50.71 E			1,378km
2	35.66	50.89	32.1 m	28°	1,432
3	35.48	51.00	27.5	74	1,105
4	35.24	50.93	27.5	142	1,396
5	35.21	50.59	24.8	212	1,372
6	35.48	50.43	26.7	284	1,585
7	35.70	50.60	33.6	343	1,287

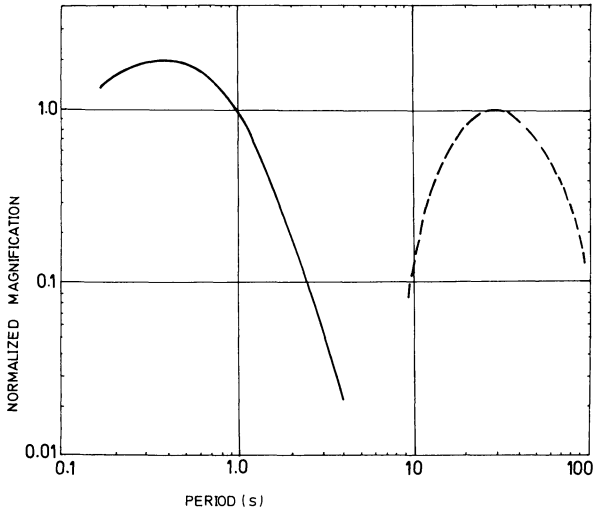

Fig. 1. Normalized response curves for short and long period channels. Short period ——, long period - - - -

meter module and a holelock with a length of 3.27 m and 14 cm maximum case diameter. One sensor system consists of three orthogonal by suspended masses of 367 gram each. Each horizontal and vertical component of the seismometer is contained in a separate module having an upper diameter of 8.9 cm and a lower diameter of 6.6 cm and a height of 14.2 cm. The displacement of the mass relative to the frame acceleration is measured by a capacitance bridge transducer, the bridge is excited with a 15,625 Hz sinusoidal voltage. Instruments response curves including long and short period filters are given in Figure 1.

In the Central Recording Station, located in Tehran on the Institute of Geophysic's territory, there are two Texas Instruments model 980 A computers and peripheral equipment used for data processing and data recording. There are 21 Long Period (LP) raw data channels, 1 to 21 Short Period (SP) raw data channel, only 5 SP channels are instrumented, 1 to 10 Long Period beams. The processed data will be recorded on Develocorders with a viewing screen to analyze data as it is recorded. The LP Develocorder with 1 to 9 traces will display 4 vertical channel beams, one horizontal transverse beam, one horizontal radial beam and

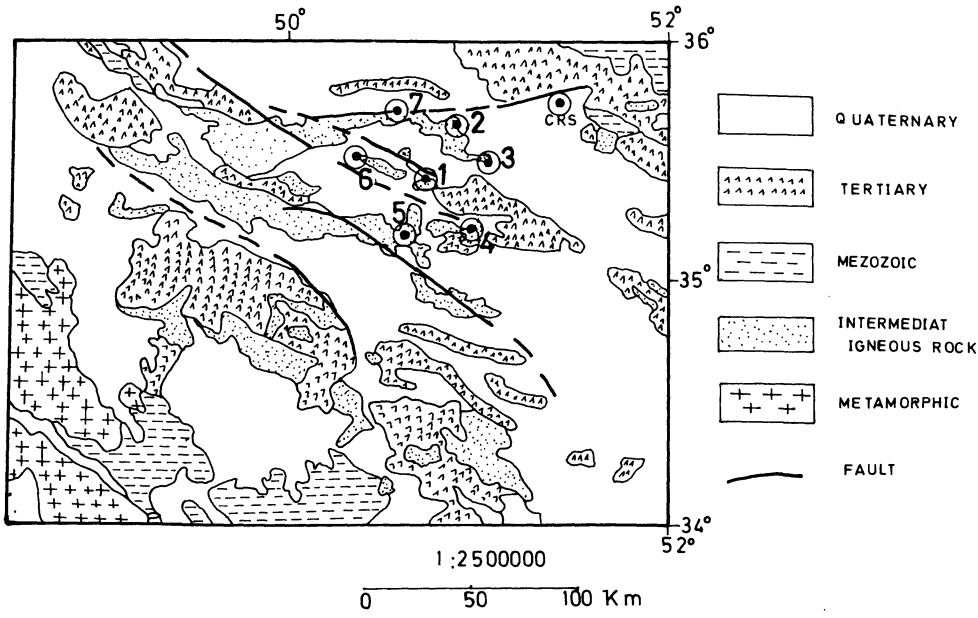

Fig. 2. Geological map of the Iranian Long Period Array

3 components of high gain single site data. The SP Develocorder with 1 to 11 traces records vertical data from 3 sites at high and low gain and the 2 horizontals from one of the 3 sites at high and low gain. There are also drum recorders for data display for 3 components of Long Period and 3 components of Short period on single pen recorders and one drum recorder with 3 pens for test data. The LP data received at the CRS are recorded and stored on magnetic tape for future off-line processing at a computer center and for editing. The data transmission over the satellite is planned for the future, but is temporarily being recorded on an auxiliary tape recorder for special analysis. The beam directions are from 0 to 359°, beam velocities are from 2.5 to 30 km/s and the beam types are vertical, radial and transverse.

More details about instrumentation can be found in references. To show the geology of the Iranian Long Period Array area, a geological map of 1:2,500,000 scale (Fig. 2) has been prepared based on the Iranian Oil Operating Company's geological map.

Most of the mezozoic sediments and metamorphic rocks are present over the south-southwestern parts of the array.

The tertiary rocks are scattered around the array. All of the remote sites are located on the Intermediate Igneous rocks.

There are several faults present within this array, of which a few are close to the remote sites. A brief picture of the geological structures of ILPA siting area is given in Figure 2.

The earth motions (analog signals) from seismometers are converted to gainranged digital signals, multiplexed into the radio carrier and transmitted each

0.05 s to the CRS. The Long Period channels are stored once per second and the Short Period channels are each stored twenty times per second. The transmission system has a capacity of about 1,800 baud of continuous data flow.

The Iranian Long Period Array began the operation in January 1976. The LP data received at CRS are stored on magnetic tape and the LP and SP-data are recorded on film and paper. The tape recorded data are transmitted to the Seismic Data Analysis Center (SDAC), optically recorded data is analyzed at CRS and at the Department of Seismology, Institute of Geophysics. This preliminary analysis is for preparation of a daily seismic bulletin and for the local and regional research; e.g., epicenter determination, magnitude calculation, vertical and lateral velocity anomaly determination, teleseismic residual studies, structural studies under the array, local focal mechanism, short and long period noise studies, etc.

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The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Agency or the U.S. Geological Survey.

References

Teledyne-Geotech: Operation and maintenance manual borehole seismometer system model 3600. part 1 and 2, 28 October 1974

Teledyne-Geotech: Operation and maintenance manual, short period filter, model 38850, 15 September 1975

Teledyne-Geotech: Operation and maintenance manual, long period filter model 38840, 15 September 1974

Texas instruments incorporated: Technical manual, operation and maintenance instructions, ER7 seismic system, 14-08-0001-14031 1 August 1975

Texas Instruments Incorporated: model 980A computer maintenance manual. System description, Volome 1, Manual 980699-9701, Jan., 1973

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Note Added in Proof. The coordinates for sites and CRS and the elevations have been estimated by the Defence Mapping Agency Topographic Center (DMATC), Department of Geodesy Geodetic Center Division are:

Site No.	Lat	Long	Elev.
1	35°24′58.3″ N	50°41′19.5″ E	1,346.6 m
2	35 39 46.1	50 53 51.5	1,172.1
3	35 28 34.0	51 01 25.5	1,106.4
4	35 14 19.3	50 54 04.2	1,373.1
5	35 12 46.2	50 34 52.0	1,350.2
6	35 28 25.2	50 25 32.2	1,540.2
7	35 42 10.1	50 36 32.0	1,305.1
CRS	35 45 10.1	51 23 19.6	1,461.7