Stress orientations and finite strain Analyses of the Sarvestan Fault Zone

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Abstract

The Sarvestan fault zone is a basement fault, which has a dextral sense of motion with some thrust component. This fault has a NNW-SSE striking and W-SW-dipping in the northern part of the fault zone. The Sarvestan fault is located in the eastern part of the Sarvestan- Maharlu depression and has displaced and dragged the Ahmadi anticline axial plane right-laterally. The study area is a part of Zagros simple folded belt that is located 85 km southeastern to Shiraz city at 29°- 29°, 30' N and 53°-53°, 30' E. In order to determine maximum, intermediate and minimum principal orientations stress of the Sarvestan fault zone, oriented samples of calcite along the fault zone were collected. .Measurements of e-twins and c-axis were carried out using 5-axis Universal Stage and the orientations of compression and tension stresses were estimated. The measured mean compression direction of the area is N40°±12°E. Finite strain of the Sarvestan fault zone was determined the using Fry method. The calculated finite strain (R_s) from the calcite grains is Rs=2.4± 0.2.

Regional geological settings

There are several right lateral faults in south eastern Zagros (the Fars provience), that extended N-S obliquely to the overall trend of the Zagros fault and fold belt. Active faults in the southeastern Zagros include of the Kazerun main fault, Sabz-Pushan, Kareh bas and Sarvestan.

The study area is part of the Zagros simple folded belt that is located 85 km southeastern part of the Shiraz city, at 29 °- 29°, 30'N and 53°- 53°,30' E (Fig.1).

The Sarvestan fault zone is accounted as the basement fault in the Zagros folded belt of Iran.

In this study, due to special application of calcite crystal in determination of the stress and strain, field studies include provision of oriented sample from calcite outcrop in silken sides of available fault planes in the area.

Stress orientation measurements

In order to determine orientations of the stress and estimate finite strain of the calcite crystals, some microscopic thin sections from the fault zone area from the selected oriented samples were selected. Finally, information from computer programs was gathered together with analysis which has been done and the quantity and directions of stress and strain was determined for study area.

In analysis of prepared microscopic thin sections, the important point was to consider appropriate e-twins of type I and II. Figure 2 shows different available calcite typ I and type II in the microscopic thin sections.

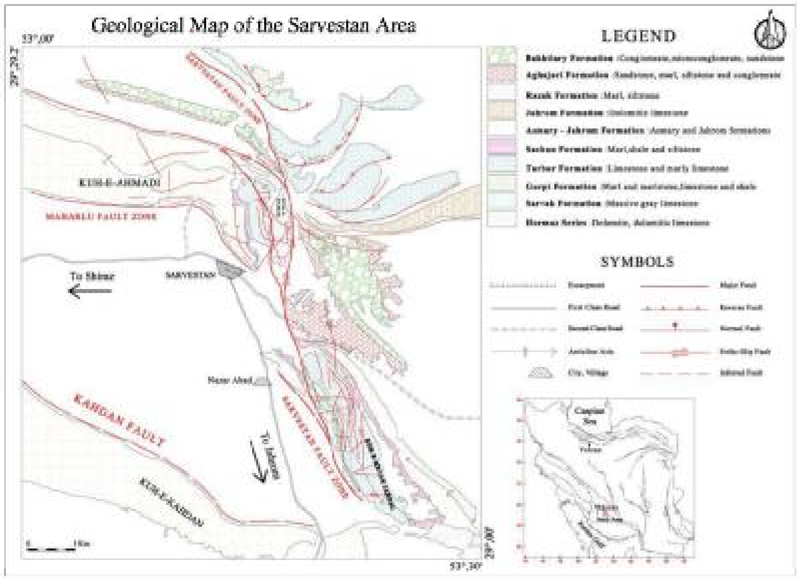

Figure 1) Geographic situation of the study area (scale1:100,000).

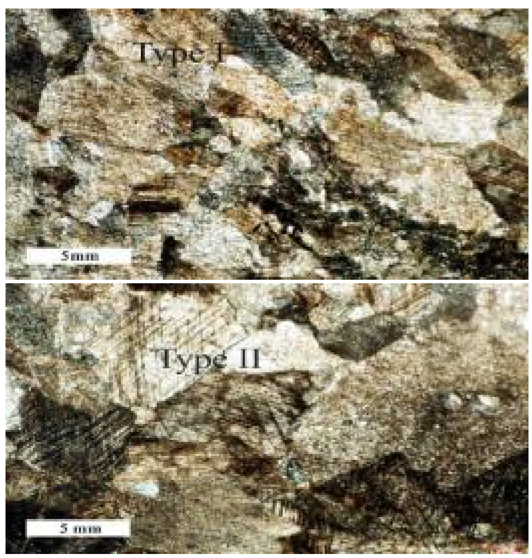

Figure 2) Microscopic photographs showing Type I and Type II.e-twins.

7 stations were selected to analyze the orientations of stress and values of finite strain in the area. Figure 3 shows the situation of compression axis direction in study area and Figure 4 shows the distribution of σ_1 and σ_3 axis orientations, which is derived from the process of unprepared data of U-stage axis using CALCSTRESS software. In all stereograms, compression axes are close to stereonet area which is due to sub-horizontal of σ_1 and σ_3 which show characteristics of the strike-slip fault component. σ_2 axis is vertical relative the other two the maximum and minimum principal stresses and is closer to the streonet center.

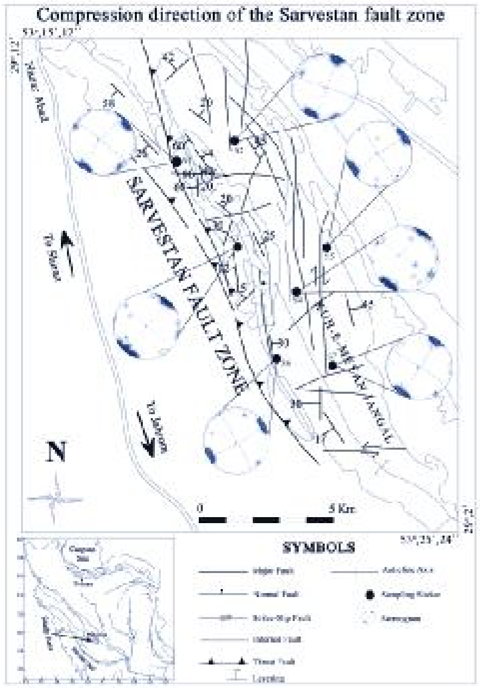

Figure 3) Structural map showing the orientations of the maximum principal stress along the Sarvestan fault zone.

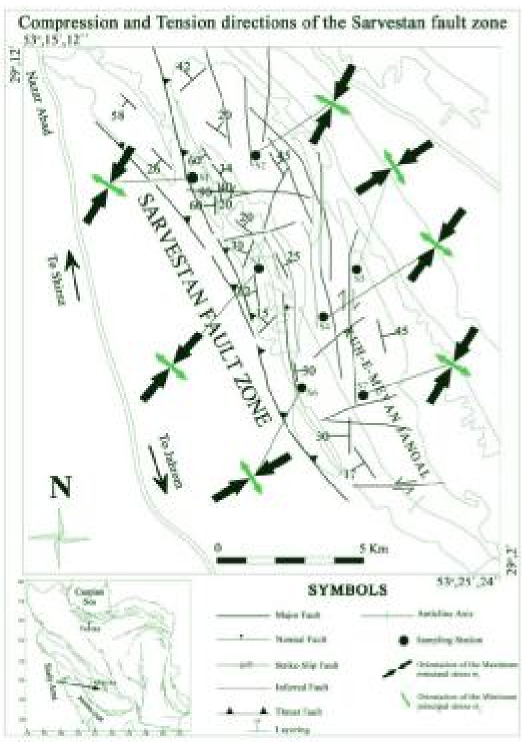

Figure 4) orientation of compression and tension axises estimated in study area.

Finite strain of the Sarvestan fault zone was determined using Fry method. The calculated mean finite strain (R_s) from the calcite grains is Rs=2.4± 0.2.this mean estimated finite strain help to decrease uncertainty relating to strain partitioning. This is possible through center to center method of Fry (1979). This method let us determine the final strain under specific situation. (Ramsay & Huber, 1983). Also calcite grains must be homogene in size before deformation (Gonzales et al., 2003). Based on the estimated finite strain and compression with the high strain zone of the Zagros transpersion (Sarkarinejad, 2007), The Sarvestan fault planes are considered high-strain zone.

Figure 5 shows estimated elliptical shape according to Fry method.

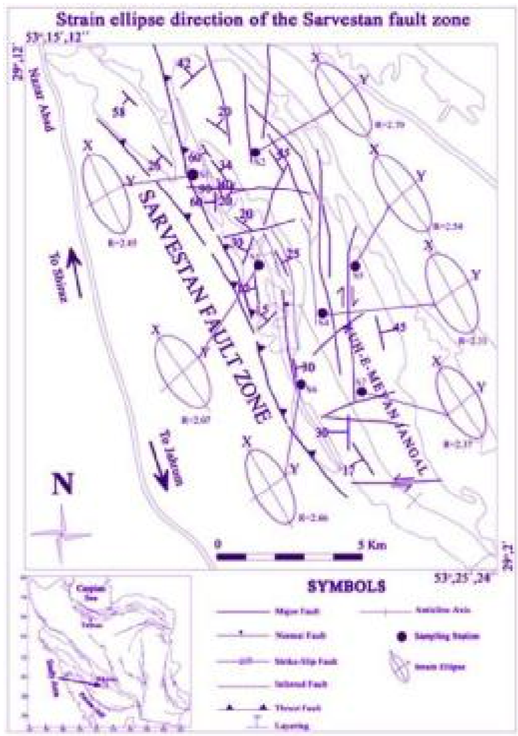

Figure 5) Structural map showing the estimated finite strain along the high-strain Sarvestan fault planes

Conclusion

Maximum principal stress axes measured from the oriented thin sections varies between N27°E to N59°E and the minimum principal stress axes varies between N30°W to N68°W. These orientations measurements in area reveal that the stress orientations changes locally along the fault zone. This might be to the rheological inhomogeneities of the basement faults, presence of salt dome in the area which controls the distribution of the stress fields. The stereograms show relationship between the compression orientations, and strike- slip mechanism of the Sarvestan fault zone

To estimate strain in the area, Fry method of center-to-center (1979) has been used to determine the finite deformation of the Sarvestan fault zone show characteristics of the high-strain zone in the area. Mean finite strain estimated using this method is Rs=2.41±0.2 which indicates that the Sarvestan fault zone has been formed in the general shear conditions. Maximum shortening trend is NE-SW and the maximum lengthening trend is NW-SE.

References

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