

DESCRIPTION AND PRELIMINARY TECTONIC EVALUATION OF THE EASTERN ISHTAR SYNTAXIS OF VENUS Eric B. Grosfils and James W. Head, Department of Geological Sciences, Brown University, Providence, R.I. 02912.

Introduction: The Eastern Ishtar syntaxis¹, centered at 71N, 75E, is a U-shaped system of ridges which exhibit a sheaf-like pattern converging at a common center when examined in plan view. This paper compares the details of the Eastern Ishtar syntaxis with terrestrial syntaxis topography and structure in order to assess its tectonic significance.

Terrestrial Syntaxes: Detailed geologic mapping of the Hazara-Kashmir syntaxis of Pakistan, located approximately 100 km northeast of Islamabad, has led to the interpretation² that it originated through rotation of compressional deformation axes and the resultant production of a series of linear imbricate thrusts (Fig. 1). The syntaxis core exhibits the following features: 1] a U-shape defined by a thrust fault with an inward facing scarp; 2] the thrust sheet defining the U-shape, the syntaxis exterior, forms a mountain belt or topographic high; 3] inside the U-shape, or the syntaxis core, is a valley or topographic low; 4] structural elements within the syntaxis core trend parallel to the strike of the flanks of the syntaxis exterior; 5] deformation of the syntaxis core results in an anticline adjacent and parallel to the west flank of the syntaxis exterior; and, 6] as indicated by metamorphic zones, conditions of maximum P/T within the syntaxis core exist in the area overlapping the location of the anticlinal zone. The first four features are characteristic of many terrestrial syntaxes, including the Assam and Hazara (comparable in size to the syntaxis in eastern Ishtar) at either end of the Himalayas^{3,4}; however, the anticline and metamorphic zones are known thus far only for the smaller Hazara-Kashmir syntaxis.

Eastern Ishtar Syntaxis: Through examination and interpretation of Venera images, the following features are identified (Fig. 2a, 2b, 2c): 1] a U-shape defined by two thrust faults with east facing scarps (the westernmost of the two scarps bends around to form the apex of the curve); 2] the eastern thrust scarp defining the syntaxis exterior forms a mountain belt, or topographic high, while the western scarp is a topographic low; 3] the syntaxis core is also a topographic high, in places over a kilometer higher than the syntaxis exterior; 4] the trend of the parallel ridges and troughs within the syntaxis core is parallel to the strike of the eastern flank of the syntaxis exterior; 5] two anticlines run adjacent and parallel to the western flank; and, 6] the southern half of each anticline is less clearly shaped, and appears more deformed than the northern half or other areas more to the east within the syntaxis core.

Comparison: Some features of the Hazara-Kashmir and Eastern Ishtar syntaxes are comparable. Both cores are defined by U-shaped mountain belts, and each core has structural elements which run parallel to a flank; in addition, both have at least one large anticline along the western flank. While the two syntaxes are similar in many ways, however, there are two major differences between them: the dip direction and elevations of the scarps defining the syntaxis, and the topographic expression of the syntaxis interiors. The tectonic model used to explain the Hazara-Kashmir syntaxis does not explain the overlapping thrust sheets seen in the Eastern Ishtar syntaxis. On the basis of topographic and geologic relationships in the surrounding region, an alternate tectonic interpretation is proposed.

Tectonic Interpretation: The region of eastern Ishtar has three broad topographic provinces--two large blocks of higher elevations (the smaller is just off the northeast corner of the topographic map) surrounded by a topographic lowland (Fig. 2b). The location of the ridge belts, shown in both the geologic map (Fig. 2c) and cross section (Fig. 2d), suggests oblique convergence between the blocks, with the main Ishtar block moving to the east and the smaller block in the northeast moving toward the southwest. Because of the oblique collision angle, the highest resistance to convergence occurs in the north where the blocks are closest together while the lowest resistance occurs to the south. On the basis of the variation in deformation intensity from north to south within the syntaxis, we infer a pole of rotation for the two blocks somewhere near the apex of the syntaxis core. The resultant crustal shortening is accommodated by formation of the ridge belts, underthrusting of the lowland region beneath the U-shaped thrust sheets which define the syntaxis' shape, and the uplift and horizontal deformation of the syntaxis core. Deformation of the fractured plains to the south of the syntaxis core (Fig. 2c), which are subsequently embayed by undeformed plains, suggests that volcanism and tectonism are occurring contemporaneously during syntaxis formation.

References: 1) J. Head (1988) *LPSC XIX*, 469-470. 2) P. Bossart *et al.* (1988) *Tectonics*, 7, 273-297. 3) R. Armijo *et al.* (1989) *J. Geophys. Res.* 94, B3 2787-2838. 4) Tapponnier *et al.* (1982) *Geology*, 10, 611-616.

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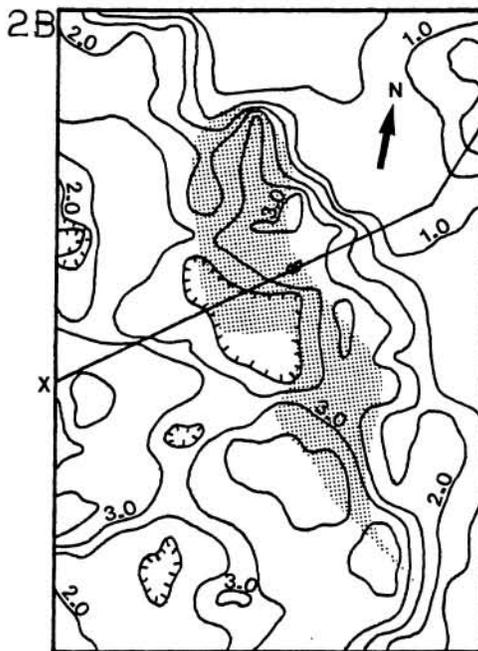
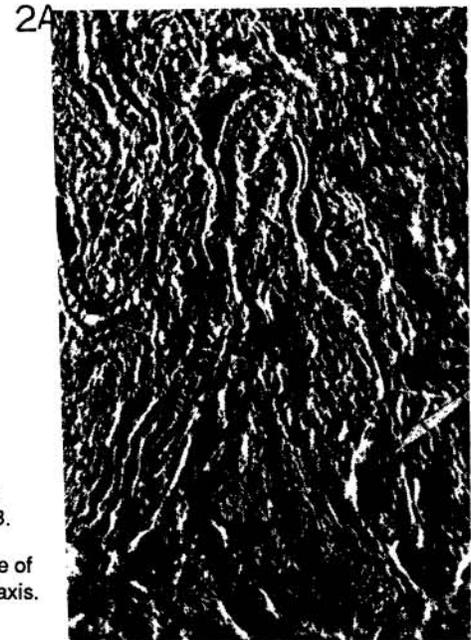
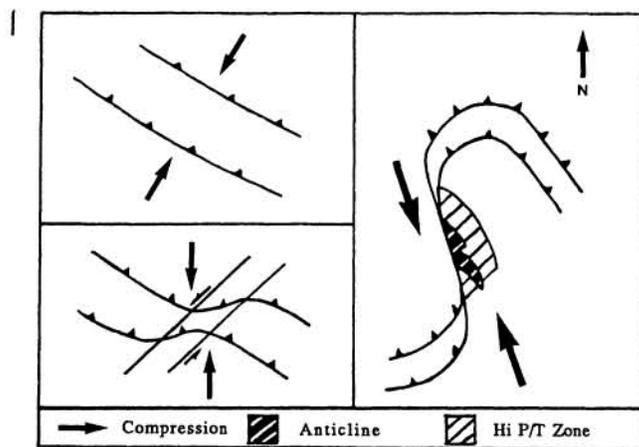


FIG. 1 : Adapted from Brossart et al., 1988.

FIG. 2a: Venera image of Eastern Ishtar Syntaxis.

2C



FIG. 2c: Geologic interpretation of the region. The syntaxis core and associated ridge belts are unshaded, and depict major ridges, scarps, folds and faults. Relatively undeformed plains are shaded with a dot pattern; a region of fractured plains, with the major ridges, scarps, and faults shown, is shaded light grey. A region of tessera is shaded with a random line-pattern; this region may be an area of "ancient syntaxis."

FIG. 2b: Topographic map, c.i.=0.5km. Shaded region is syntaxis core, X and X' mark the ends of the cross section.

FIG. 2d: Cross section X-X' taken perpendicular to the trend of the syntaxis. Fault dips are interpreted from Fig. 2a.

