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Characteristic features and structural evolution of a post collisional basin: The Sivas Basin, Central Anatolia, Turkey

Ali Yılmaz[a,*], Hüseyin Yılmaz[b]

[a]Engineering Faculty, Department of Environmental Engineering, Cumhuriyet University, 58140 Sivas, Turkey
[b]Engineering Faculty, Department of Geophysical Engineering, Cumhuriyet University, 58140 Sivas, Turkey

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Abstract

The ENE-SSW trending Sivas Basin is located at the easternmost wedge-like tip of the Central Anatolian Block and exhibits characteristics of two other basins, one in west-central Anatolia and the other in eastern Anatolia. The Sivas Basin started to form within a collisional mosaic during Maastrichtian time with the Pre-Maastrichtian basement, the latter composed of continental metamorphic rocks, Jurassic-Lower Cretaceous platform carbonates of the Tauride Belt, and ophiolites and ophiolitic melánge derived from closure of the northern branch of Neo-Tethys. Similar Tertiary basins were developed on comparable collisional mosaics in other parts of Anatolia.

The Sivas Basin is asymmetrical in both the longitudinal and transversal directions. Its infill is dominated by a thick Maastrichtian-Tertiary shallow marine-continental succession resting unconformably on Pre-Maastrichtian basement rocks and dissected into several subbasins. This infill consists of post-collisional deposits which overlie paleotectonic units unconformably and each subbasin is bounded by northeast–southwest trending oblique-slip faults exhibiting dominant strike-slip. The subbasins are characterized by contrasting stratigraphic successions, although all are composed of interstratified continental and shallow-marine facies. Both the northern and southern margins of the subbasins include Upper Eocene olistostromes containing mega-blocks of varied origin. The latter are sourced in paleotectonic units and were reworked in a shallow-marine depositional setting. The fill of the middle subbasins exhibits strong vertical and lateral facies changes, characterized by local and regional unconformities and includes continental to shallow-marine volcanic rocks.

This basin was deformed under north–south-directed compression during Late Pliocene-Quaternary times during the neotectonic phase of deformation. This deformation divided the basin into new, small-scale, mainly pull-apart subbasins including those at İmranlı, İşhanı, Altınyayla and Şarkışla. From stratigraphic and structural correlations, a post collisional intra-continental basin model for the Sivas Basin is preferred.

Keywords: Post collisional basin; Central Anatolia; Turkey

1. Introduction

The Sivas Basin is a 60 km long, 30 km wide Tertiary basin in northeastern Turkey, developed mainly on the Neo-Tethyan ophiolitic suture separating the Tauride Platform in the south from the Pontides in the north (Fig. 1). Numerous general geological studies of the region have been published (e.g. Altınlı, 1963; Baykal and Erentöz, 1966; Artan and Sestini, 1971; Kurtman, 1973; Tatar, 1977; Yılmaz, 1980, 1981; Yılmaz and Özer, 1984; Gökten, 1983, 1984; Sümengen et al., 1987; Yılmaz et al., 1989; İnan et al., 1993; Alpaslan, 1993; Temiz, 1996; Kavak et al., 1997; Özden et al., 1998; Ocakoğlu, 1999; Çubuk and İnan, 1999; Kangal and Varol, 1999; Koşun and Çiner, 2002; Çiner et al., 2002).

Studies interpreting the structural evolution of the Sivas Basin, however, are few. In this context, a general paleogeographic evolutionary model of Gökçen (1981) is one of a few that attempts to address this question. In addition, it has been suggested that the Sivas Basin formed during closure of the northern branch of Neo-Tethys in Early Tertiary times as a remnant basin between the

* Corresponding author. Tel.: +90 346 219 1010/1289; fax: +90 346 219 1177.
E-mail address: ayilmaz@cumhuriyet.edu.tr (A. Yılmaz).

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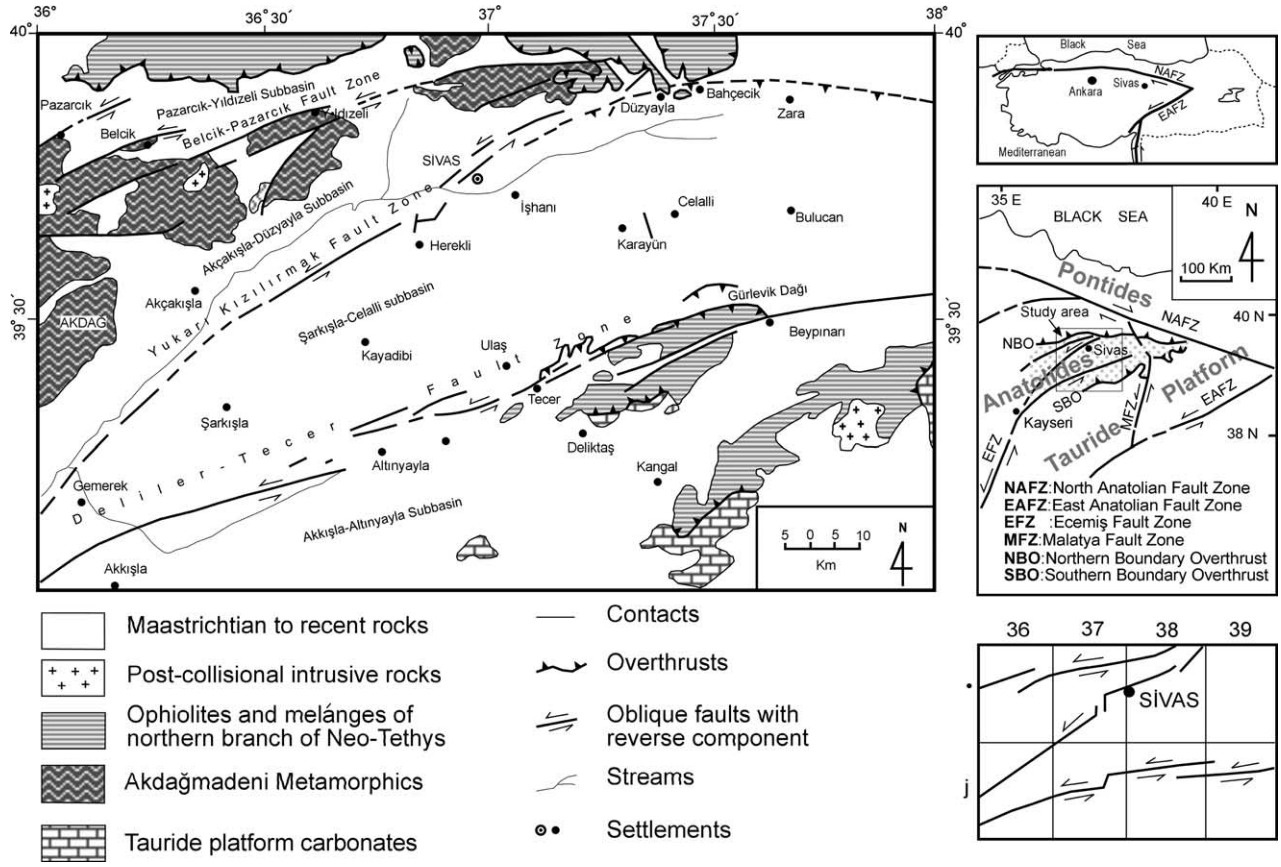

Fig. 1. Location and simplified geologic map showing tectonic units of the Sivas Basin.

Pontide and Tauride Platforms (Kelling et al., 1989; Cater et al., 1991; Poisson et al., 1996). Ophiolites on the southern side of the basin are interpreted as products of the Inner Tauride Ocean that closed sometime between the end of the Eocene and Early Miocene times (Şengör and Yılmaz, 1981; Koçyiğit, 1990; Gökten, 1993a). However, the relationship between the northern branch of Neo-Tethys and the Inner Tauride Ocean, and the setting of the Sivas Basin between them, is an unresolved question. As a result, an alternative solution is suggested; this interprets the basin as an intracontinental basin that developed mainly after closure of the northern branch of Neo-Tethys and accompanied neotectonic collisional processes in Central Anatolia (Yılmaz, 1994, 1998).

In view of these contradictory analyses, the present paper re-evaluates the main geological characteristics of the Sivas Basin in order to constrain the structural framework of the basin.

Based on new field data, the Sivas Basin is found to have formed on a basement consisting of ophiolitic units of the northern branch of Neo-Tethys obducted onto the Tauride Platform and its metamorphic equivalents such as the Akdağmadeni-Kırşehir metamorphic terrain. The basement of the basin represents mainly a suture zone developed between the Pontide Arc and Tauride Platform. Hence, the Sivas Basin is of post-collisional origin and may be a peripheral or foredeep basin according to the classification of Dickinson (1974) and Miall (1981). The sedimentary infill of the basin is made up of molasse (Kukal and Al-Jassim, 1971) with shallow marine interbeds and is divided into four subbasins by left lateral oblique fault zones with reverse components (Fig. 1).

Interpretations of the evolution of the Sivas Basin outlined above are the result of a scarcity of geological evidence. In this study, we aim to rectify this situation by providing detailed geological data from the basin. These data include the regional geological setting, and stratigraphical, sedimentary and tectonic features of the region; the little known differences between the subbasins and the structural evolution of the basin are also described.

2. Regional geological setting of the study area

The Sivas Basin is developed on Anatolide and Tauride tectonic units as defined by Ketin (1966). An important question relates to the type of basement on which the basin formed. Since the boundaries of the basin are overthrusts or left-lateral oblique faults with reverse components, there is no outcrop of basement within the central basin. This makes