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Structure, kinematics and ages of transpression during strain-partitioning in the Chongshan shear zone, western Yunnan, China

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ABSTRACT

The Chongshan shear zone extends from the eastern Himalayan Syntaxis to the Lincang Granitic pluton in Yunnan Province, China. The structure and kinematics show that the shear zone comprises mainly of mylonitic gneiss–migmatite and schist with a dextral-dominated strike-slip motion in an N–S trending northern segment, and a sinistral strike-slip shear in NW–SE trending middle and southern segments. Both were developed under a bulk, regional-scale sinistral transpression. SHRIMP and LA-ICPMS U–Pb and $^{40}Ar/^{39}Ar$ dating reveal two Tertiary magmatic events along the zone, followed by younger sinistral strike-slip shear. The Eocene magmatic event (c. 55–38 Ma), followed by metamorphism at c. 36 Ma, happened before the strike-slip motion. The strike-slip shear along the zone began c. 32 Ma, which generated shear heating from 32 to 22 Ma. The $^{40}Ar/^{39}Ar$ ages of syn-kinematic micas, range from 19 to 14 Ma, and indicate that the strike-slip shear continued to this time with coeval transpressional exhumation and uplift of the metamorphic rocks along the Biluoxueshan–Chongshan chain. The Chongshan zone is thus a Cenozoic shear zone, which was contemporaneous with motion on the left-lateral Ailao Shan-Red River shear zone and the right-lateral Gaoligong shear zone, and should be important in accommodating the northwards movement of India during collision. During Oligocene to Miocene times, the continental block that was extruded between the Ailao Shan-Red River and Gaoligong shear zones was dismembered into at least two major fragments by the Chongshan shear zone.

1. Introduction

Following the India–Asia collision at equatorial latitudes approximately since 54–49 Ma (Dewey et al., 1989; Zhu et al., 2005a), India has indented into the Asian continent c. 2000 km northwards, forming the Himalayan orogen, crustal thickening and the uplift of the Tibetan plateau (e.g. Searle et al., 2007). Related to this collision, widespread intra-continental deformation occurred in SE Asia along large-scale NW–SE trending strike-slip shear zones (Tapponnier et al., 1982, 1986; Peltzer and Tapponnier, 1988). Abundant geological and geochronological evidence implies that the Ailao Shan-Red River shear zone in southern China and Vietnam, the Wang Chao (or Mae Ping) and Three Pagadas strike-slip fault zones in northern Thailand, the Gaoligong shear zone and Sagaing fault in southern China and Burma all played a key role in the eastward movement of fault-bounded continental blocks during the northward indentation of the Indian continent (Tapponnier et al., 1986; Leloup et al., 1995, 2007; Lacassin et al., 1997; Wang and Burchfiel, 1997; Morley et al., 2001; Morley, 2002; Gilley et al., 2003).

The Chongshan shear zone (Fig. 1), also referred as the Chongshan metamorphic zone because of the good outcrops of metamorphic and intrusive rocks, extends from the eastern Himalayan Syntaxis in the north, then along the Biluoxueshan–Chongshan mountain to the south, and finally converges with the Lincang Granite pluton in the south (Fig. 2; BGMRYP, 1987, 1990; Wang and Burchfiel, 1997; Akciz et al., 2008). This zone marks the boundary between the Lanping-Simao terrane in the east and the Shan-Thai block (Subimasu) in the west (Fig. 2), a topographic high extending into Thailand (Morley, 2004; Searle et al., 2007). Metamorphic rocks exposed in this zone include mica schists, gneisses, marbles and quartzites with metamorphic grades ranging from greenschist to high-amphibolite facies, some of these rocks have been suggested to be Precambrian basement (BGMRYP, 1987; Heppe et al., 2007). Although the Chongshan shear zone is an important geological boundary, the structure, kinematics and geochronology along it have not been constrained very well other than a recently proposed early Cenozoic strike-slip shear event by Akciz et al. (2008). Other

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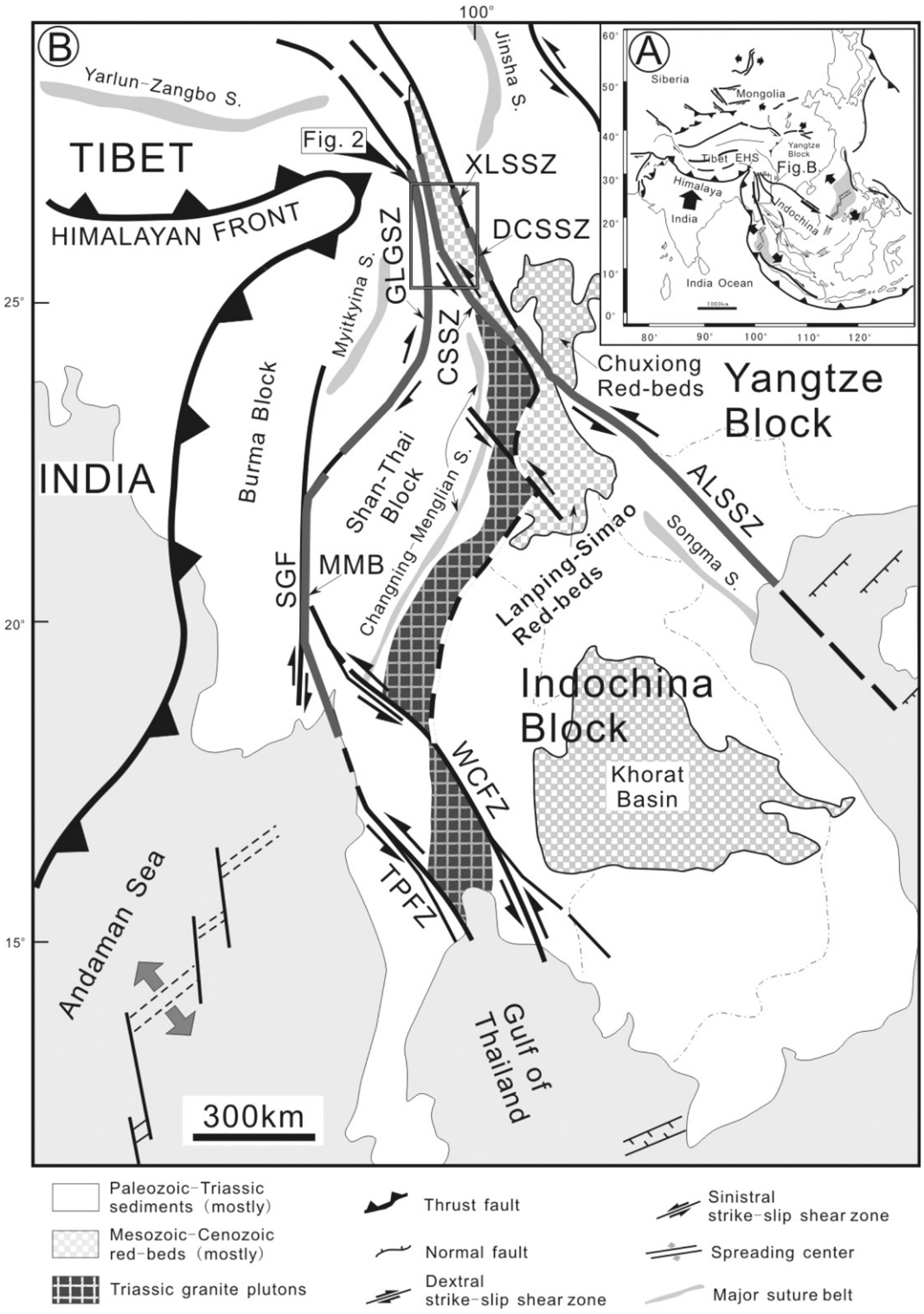

Fig. 1. Schematic tectonic map of SE Asia showing major fault and shear zones. Inset (A) shows the extrusion of Indochina in response to northward penetration by India (modified after Peltzer and Tapponnier, 1988; Tapponnier et al., 1990; Leloup et al., 1995; Morley et al., 2001; Morley, 2007). (B) CSSZ, Chongshan shear zone; Xuelongshan shear zone (XLSSZ), Diancangshan shear zone (DCSSZ) and Ailao Shan shear zone (ALSSZ) belong to the Ailao Shan-Red River shear zone; EHS, Eastern Himalayan Syntaxis; WCFZ, Wang Chao fault zone; TPF, three Pagodas fault zone; SGF, Sagaing fault; MMB, Mogok metamorphic zone.

recent geochronological analyses on the southern Chongshan mountain also revealed some Cenozoic events (Wang et al., 2006; Heppe et al., 2007). In order to get a better understanding of this poorly documented zone, we conducted a detailed study between latitudes 24°–28° north and longitudes 99°– 100° east (Fig. 1).

We have carried out a structural and kinematic study along the Chongshan shear zone and across three sections in western Yunnan, China (Fig. 2). We also present sensitive high resolution ion microprobe (SHRIMP) and laser ablation-multi-collector-inductively coupled plasma mass spectrometer (LA-ICPMS)