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1 Triassic tectonics of the Southern margin of the South China Block

2

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13

14 **ABSTRACT**

15 Middle Triassic orogens are widespread around and inside the South China Block  
16 (SCB). The southern peripheral belts that develop from NW to SE, namely Jinshajiang,  
17 Ailaoshan, NW Vietnam, NE Vietnam, Yunkai and Hainan exhibit striking similarities, with  
18 Permian-Early Triassic magmatic arc, ophiolitic mélange, NE to N-directed synmetamorphic  
19 ductile nappes, and fold-and-thrust belt. These collisional belts result from oceanic, then  
20 continental subduction of the SCB below Indochina. Eastward of Hainan Island, a Triassic  
21 suture is hypothesized offshore of the SCB. Within the SCB, the Xuefengshan is a Middle  
22 Triassic intracontinental orogen with NW-directed folds and thrusts, and an intracrustal  
23 ductile decollement. This orogen accommodated the Middle Triassic continental subduction  
24 of the Western part of the SCB below the Eastern part. At variance to the generally accepted

25 models, the inter- and intra-continental Triassic orogens of the SCB are interpreted here as the  
26 result of South-directed subductions of the SCB.

27

28 Key words:

29 Triassic tectonics, Continental collision, Intracontinental subduction, South China Block,  
30 Indochina Block

31

32

### 33 **1. Introduction**

34 It is well acknowledged that the architecture of Asia results of the amalgamation of  
35 large continents such as Siberia, N. China, S. China, Tarim, Indochina, India, and several  
36 microcontinents: Lhasa, Qiangtang, Qaidam, etc... (e.g. Metcalfe, 2013; Fig. 1). The South  
37 China Block (SCB) is one of the most complex as it underwent a long Phanerozoic evolution  
38 after its Neoproterozoic formation before 850 Ma during a collisional event that welded the  
39 Yangtze and Cathaysia Blocks (e.g. Charvet et al., 1996; Li et al., 2007a; Fig 2). During the  
40 Early Paleozoic, the SCB was welded to the N. China block along the Qinling-Dabie belt (e.g.  
41 Mattauer et al., 1985; Li et al., 2007b; Faure et al., 2008; Dong et al., 2011; Liu et al., 2013).  
42 Between Late Ordovician and Early Silurian, the closure of a Neoproterozoic Nanhua rift was  
43 responsible for the building of an intracontinental belt (e.g. Wang and Li, 2003; Faure et al.,  
44 2009; Charvet et al., 2010; Wang et al. 2013). From Devonian to Early Triassic, during ca 170  
45 my, the SCB behaved as a stable continent covered by a carbonate platform. However, in the  
46 Late Permian, the SW part of SCB, in Yunnan and Guangxi, experienced a huge intraplate  
47 magmatism coeval with rifting, known as the Emeishan Large Igneous Province (Ali et al.,  
48 2005; Fig. 2).

49           The Triassic appears as the most important period for the tectonic development of the  
50 SCB. Since the recognition of a Norian unconformity and the definition of "Indosinian"  
51 movements in Central Vietnam (Deprat, 1915; Fromaget, 1941), the term Indosinian has been  
52 ascribed to all Triassic tectonic and magmatic events throughout Asia, even if these features  
53 were geodynamically unrelated to Vietnamese ones. As numerous dates are now available, the  
54 Middle Triassic stratigraphic age will be preferred to "Indosinian".

55           Triassic events are widespread all around the SCB (Fig. 2). South of the Early  
56 Paleozoic Qinling belt, Triassic top-to-the-S ductile shearing, HP and UHP metamorphism,  
57 and plutonism are documented (e.g. Hacker et al., 1998; Lin et al., 2000; Ratschbascher et al.  
58 2003; Li et al. 2007b; Faure et al., 2008; Liu et al., 2013). To the NW, in spite of an intense  
59 Cenozoic reworking, a SE-directed Triassic thrusting is recognized in the Longmenshan belt  
60 (e.g. Burchfiel et al., 1995; Roger et al. 2008; Robert et al., 2010). The Jinshajiang,  
61 Ailaoshan, and N. Vietnam belts represent the Western and Southwestern boundaries of the  
62 SCB. Furthermore, Middle Triassic events are responsible for the development of the  
63 Xuefengshan belt in the internal part of the SCB (Chu et al., 2012a,b; Wang et al., 2013; Fig.  
64 2). The architecture and geodynamic evolution of these belts are still controversial, but it is  
65 widely accepted that the SCB belonged to the upper plate above a north (NE or NW)-dipping  
66 subduction zone (e.g. Wang et al., 2013; Li and Li, 2007).

67           The aim of this paper is to synthesize the Triassic tectonic features that develop along  
68 the southern margin of the SCB, and in its interior as well. Then a possible geodynamic  
69 interpretation, at variance to the present paradigm, will be discussed. The Triassic events of  
70 the northern part of the SCB, and the Jurassic and Cretaceous ones of the interior of SCB will  
71 not be addressed here.

72

73 **2. Triassic orogens of N. Vietnam**

74 It is sometimes proposed that the Red River Fault (RRF) is the boundary between SCB  
75 and Indochina. The RRF is a polyphase fault with Miocene sinistral ductile strike-slip (also  
76 referred to as the Ailaoshan-Red River shear zone), and a Plio-Quaternary dextral motion.  
77 The left-lateral ductile displacement developed in response to the Indian collision was  
78 variously estimated from a few tens to several hundred of km (e.g. Tapponnier et al., 1986;  
79 Leloup et al., 1995, 2006; Searle, 2006). The strike-slip faulting accounts for the Cenozoic  
80 tectonics, but when dealing with the Triassic events, the RRF cannot be considered as a plate  
81 boundary as ophiolites, subduction complexes, or HP metamorphic rocks are lacking. In  
82 contrast, two ophiolitic belts are recognized in NW and NE Vietnam on both sides of the  
83 RRF, along the Song Chay and Song Ma faults (Fig. 2; Lepvrier et al., 1997, 2008, 2011;  
84 Faure et al., 2014).

85

#### 86 2.1. The NW Vietnam (Song Ma) belt

87 From SW to NE, several litho-tectonic zones are recognized (Figs. 2, 3A). 1)  
88 Permian-Early Triassic volcanic and sedimentary rocks of the *Sam Nua zone*, overlying an  
89 Early Paleozoic series, are interpreted as a magmatic arc (Tran et al., 2008a; Liu et al., 2012).  
90 2) The *Song Ma zone* formed by ultramafic, mafic rocks and deep marine sediments  
91 represents an ophiolitic suture. 3) The *Nam Co metamorphic rocks*, developed at the expense  
92 of Neoproterozoic terrigenous series, and Paleozoic limestone and sandstone, correspond to  
93 the sedimentary cover of a continental basement ductilely deformed during the NE-ward  
94 thrusting of the Song Ma ophiolites. 4) Farther North, folded unmetamorphosed successions  
95 of Devonian to Carboniferous limestone, Permian volcanics, Early Triassic clastics, and  
96 Middle Triassic carbonates represent the outer zone (*Son La-Lai Chau zone*) of this belt.  
97 There, Late Permian alkaline basalts and volcanoclastites form the Song Da rift. Although  
98 sometimes considered as ophiolites, these rocks, emplaced in an intraplate setting, belong to

99 the Emeishan Large Igneous Province (Ali et al., 2005; Tran et al., 2008b; Tran and Vu,  
100 2011). The Permian Tule acidic rocks are also relevant to this bimodal magmatism (Tran and  
101 Vu, 2011). 5) Lastly, the Proterozoic basement, stratigraphically overlain by a Paleozoic  
102 sedimentary cover, is called the *Posen-Hoabinh zone* that forms the deepest part of the NW  
103 Vietnam belt.

104 The NW Vietnam belt exhibits a structural and metamorphic polarity decreasing from  
105 SW to NE. Late Triassic sandstone and conglomerate unconformably cover deformed rocks.  
106 Biotite and muscovite  $^{40}\text{Ar}/^{39}\text{Ar}$ , zircon U/Pb, and monazite chemical U/Th/Pb ages around  
107 245-230 Ma argue for a Middle Triassic age for the nappe architecture of the NW Vietnam  
108 belt (Lepvrier et al., 1997, 2008, Nakano et al., 2008, 2011).

109

## 110 2.2. The NE Vietnam (Song Chay) belt

111 NE of the RRF, another Triassic belt develops with the following SW to NE zonation  
112 (Lepvrier et al. 2011; Faure et al. 2014; Figs. 2, 3A). 1) The *Dai Nuy Con Voi* is a NW-SE  
113 striking Cenozoic HT antiform developed from grauwacke and pelite hosting granodiorite,  
114 diorite and gabbro plutons of Permian-Triassic age (Gilley et al., 2003; Zelazniewicz et al.  
115 2013). This zone is interpreted as a magmatic arc. 2) The *Song Chay ophiolitic mélange* is  
116 composed of serpentinites, mafic rocks, limestone, and chert blocks included in a terrigenous  
117 matrix of Triassic age. 3) The *NE Vietnam nappe* consists of Cambrian-Ordovician  
118 terrigenous rocks, and Devonian to Permian carbonates. Ordovician porphyritic granites (e.g.  
119 the Song Chay massif) are now changed into augengneiss. N- to NE-verging folds and thrusts  
120 deform the entire lithological succession. Biotite-garnet-staurolite micaschist yields a  
121 monazite U-Th-Pb age at  $246\pm 10$  Ma (Faure et al., 2014). 4) The *outer zone* is a Paleozoic  
122 lithological succession similar to that of the NE Vietnam nappe covered by a thick Middle  
123 Triassic turbidite series with acidic lava flows and ashes. This formation includes olistoliths

124 of alkaline basalt, gabbro and limestone. Similar mafic rocks crop out in China where they  
125 intrude the late Paleozoic limestone platform. They have been ascribed to the "Babu  
126 ophiolites" (Fig. 2, Zhong 2000; Cai and Zhang, 2009), but their geological setting and  
127 geochemistry show that they are intraplate basalts corresponding to remote parts of the  
128 Emeishan Large Igneous Province (e.g. Zhou et al. 2006, see discussion in Faure et al., 2014).  
129 The NE Vietnam belt extends in China between Kunming and Nanning, the flat lying Late  
130 Paleozoic limestone platform is involved in N-directed folds and thrusts upon the Middle  
131 Triassic turbidite (Fig. 4C).

132 In summary, both the NW and SE Vietnam belts are collisional orogens formed by a  
133 SW-ward subduction of oceanic, then continental lithosphere. Due to their lithological,  
134 structural, and chronological similarities, the two belts have been interpreted as the result of a  
135 duplication of a single Triassic orogen by the Cenozoic left-lateral strike-slip shearing of the  
136 **Ailaoshan-Red River shear zone** (Faure et al., 2014).

137

### 138 **3. The western extension of the N. Vietnam orogens**

#### 139 *3.1. The Ailaoshan Belt*

140 This NW-SE 500km-long belt (Fig. 2) is subdivided into several narrow stripes by  
141 belt-parallel strike-slip faults. In spite of the intense Cenozoic shearing (e.g. Leloup et al.,  
142 1995), the Ailaoshan is commonly acknowledged as a Triassic suture zone between the SCB  
143 and Indochina-Simao block but structural details and subduction polarity are disputed (e.g.  
144 Zhong 2000; Jian et al., 2009a,b; Fan et al., 2010; Lai et al., 2013a,b; Wang et al., 2013).  
145 From SW to NE, four litho-tectonic zones ascribed to the Triassic orogen are recognized (Fig.  
146 2). 1) The *Western Ailaoshan*, characterized by volcanic and sedimentary rocks, is  
147 unconformably overlain by Late Triassic red conglomerate and sandstone. Basalt and  
148 andesite, dated between 287 and 265 Ma, were originated in a magmatic arc installed upon a

149 Silurian-Devonian terrigenous series (Jian et al., 2009a; Fan et al., 2010). 2) The *Central*  
150 *Ailaoshan* contains serpentinite, gabbro, dolerite, plagiogranite, basalt, chert, and limestone  
151 blocks enclosed into a terrigenous matrix (Lai et al., 2014b). Zircon from plagiogranite yields  
152 U-Pb ages at 383-376 Ma, 365 Ma, and 328 Ma interpreted crystallization age of ophiolitic  
153 protoliths (Jian et al., 2009b; Lai et al., 2014b). This domain represents an ophiolitic mélange  
154 but the age of the matrix is unknown. 3) The *Eastern Ailaoshan* consists of gneiss, micachists,  
155 amphibolites, marbles, and migmatites that form a Paleoproterozoic basement, partly  
156 reworked during the Cenozoic (Lin et al., 2012). Middle Triassic carbonate covers the  
157 crystalline basement. 4) The *Jinping area* exposes Late Permian mafic lava, pillow breccia,  
158 agglomerate, and volcanoclastites (Wang et al., 2007). Furthermore, felsic volcanites dated at  
159 ca 246 Ma result of syn- to late-collisional crustal melting (Lai et al., 2014a).

160 A steeply dipping foliation and a subhorizontal lineation are the main ductile  
161 structures developed during the Cenozoic shearing as they involve the Late Triassic rocks.  
162 Nevertheless, a steeply dipping stretching lineation with top-to-the NE sense of shear and NE  
163 verging folds are also observed (Fig 4B). These structures, incompatible with the strike-slip  
164 event, and not observed in the Late Triassic or younger rocks, are of Middle Triassic in age.

165 Thus in spite of the Tertiary overprint, the Ailaoshan belt is comparable with the N.  
166 Vietnam belts. Namely, the Western, Central, and Eastern Ailaoshan zones are equivalent to  
167 the Sam Nua, Song Ma, Posen-Hoabinh zones, respectively. The Sonla-Laichau zone pinches  
168 out in the Ailaoshan, except in the Jinping area where magmatic rocks are similar to the Song  
169 Da rift.

170

### 171 3.2. *The termination of the NE Vietnam Belt*

172 The NE Vietnam Belt abruptly ends in China (Fig. 2). The Dai Nuy Con Voi  
173 metamorphics are surrounded by Permian-Early Triassic volcanites and grauwackes



174 corresponding to the magmatic arc, but ophiolites are not exposed. Folded and thrustured  
175 Paleozoic rocks are equivalent to the NE Vietnam nappe. To the north, Middle Triassic  
176 turbidites of the Youjiang basin involved in N-verging folds correlate with the outer zone of  
177 NE Vietnam.

178

### 179 *3.3. The Jinshajiang Belt*

180 At the edge of the Tibet plateau, the Triassic Jinshajiang orogen is documented by the  
181 Late Triassic unconformity overlying a folded Middle Triassic ophiolitic mélange with basalt,  
182 chert, and limestone blocks (Fig. 4A, Zhong 2000; Wang and Metcalfe, 2000). This mélange  
183 overthrusts to the East the Late Paleozoic-Triassic carbonate platform of the SCB. To the  
184 West, a Permian-Early Triassic magmatic arc argues for a west-directed subduction. The  
185 bimodal magmatism at 245-237 Ma is interpreted as syn- to post-collisional (Zi et al., 2012).  
186 The Jianshajiang Belt exhibits lithological and structural features similar to those of the  
187 Ailaoshan and N Vietnam orogens.

188

## 189 **4. The eastern extension of the N. Vietnam orogens**

### 190 *4.1. The Yunkai Massif*

191 In Guangxi, the Late Triassic-Jurassic red sandstone of the Shiwandashan basin (**SB in**  
192 Fig. 2) is a post-orogenic molasse with respect to the Triassic orogeny (e.g. Hu et al., 2014).  
193 The Yunkai massif consists of Early Paleozoic HT metamorphics, migmatites, and Triassic  
194 granites tectonically surrounded by weakly metamorphosed Devonian-Carboniferous  
195 sedimentary rocks (e.g. Wang et al., 2007; Lin et al., 2008). The metamorphic rocks belong  
196 to the Early Paleozoic orogen of SE China but were intensely reworked by the Triassic events.  
197 The flat-lying foliation and NE-SW stretching lineation, associated with a top-to-the-NE  
198 ductile shearing developed at ca 250-240 Ma. During this event, the Early Paleozoic granites

199 were changed to orthogneiss (Fig. 4D). The Yunkai massif is a 100km-scale basement nappe  
200 that overthrusts northward onto the Late Paleozoic sedimentary rocks of the SCB (Figs. 3C,  
201 4E). As ophiolites are lacking there, the eastward extension of the Song Chay suture should  
202 be searched more to the South in Hainan Island (Fig.2).

203

#### 204 *4.2. Triassic tectonics in Hainan Island*

205 The tectonic evolution of Hainan Island remains controversial. The Cretaceous and  
206 younger extensional events are not considered here. Late Triassic plutons seal the **main**  
207 **ductile** deformation (Fig. 3B). N-verging folds and thrusts deform the Early Paleozoic series  
208 and the underlying Proterozoic basement. Granodiorites and biotite granite **with calcalkaline**  
209 **geochemical signatures, and yielding** zircons **SHRIMP U-Pb** ages **at 267±3Ma Ma and 263±3**  
210 **Ma by SHRIMP method**, are interpreted as the **"Wuzishan magmatic arc"** (Li et al., 2006).  
211 North of this arc, a Late Permian-Early Triassic terrigenous series including Carboniferous  
212 gabbro, basalt, siliceous rocks and limestone is interpreted as a mélangé (Fig. 4F; Li et al.,  
213 2002). This formation is ductilely deformed with top-to-the-N kinematics dated at ca 250-240  
214 Ma by  $^{40}\text{Ar}/^{39}\text{Ar}$  method **on micas** (Zhang et al., 2011). In spite of a still limited knowledge,  
215 the Hainan Island appears as a suitable site for the eastern extension of the Song Chay suture.

216

### 217 **5. Triassic intracontinental tectonics in East SCB**

#### 218 *5.1. The Xuefengshan Belt*

219 Middle Triassic tectonics is not limited to the SCB margins. In central SCB (E. Hunan  
220 and Guangxi), the Xuefengshan Belt is a NNE-SSW striking 700 km long belt dominated by  
221 NW-directed thrusts and folds. SE-verging folds are interpreted as secondary back-folds (Chu  
222 et al., 2012a; **Fig. 5**). A ductile decollement layer, intruded by Late Triassic plutons dated at  
223 225-215 Ma **by SIMS U-Pb method on zircon** (Chu et al., 2012c), exhibits a NW-SE striking

224 stretching lineation, and top-to-the-NW sense of shear (Chu et al., 2012b). This 500 km wide  
225 fold-and-thrust belt involves the entire Neoproterozoic to Early Triassic sedimentary pile to  
226 the west of the Chenzhou-Linwu fault (CLF in fig. 2). This fault, devoid of ophiolites and  
227 subduction mélange, is not a suture zone, but an intracontinental "scar". In order to balance  
228 the ca 300 km of shortening experienced by the sedimentary rocks overlying the decollement  
229 layer, a SE-ward continental subduction of the same amount must have taken place in the  
230 crystalline basement of the western part of SCB (Chu et al., 2012a).

231

## 232 *5.2. Coastal and eastern SE China*

233 E-W striking folds develop south of the Jiangshan-Shaoxing Fault (Fig. 2). The Late  
234 Triassic regional unconformity argues for a Middle Triassic event (Shu et al., 2008). As  
235 documented in the Jiuling area (Chu and Lin, 2014), upright folds are lateral ramps related to  
236 the Xuefengshan belt. The E-W elongated Wugongshan dome located immediately south of  
237 the Jiangshan-Shaoxing fault (Fig. 2; Faure et al., 1996) might be also developed during the  
238 reactivation of this Neoproterozoic suture. The Triassic ductile deformation is probably  
239 underestimated in the eastern part of SCB (Wang et al. 2014).

240 In the coastal area of SE China, widespread Jurassic and Cretaceous granites and  
241 volcanites hide older formations. West of Fuzhou, Middle Triassic rocks deformed by N-  
242 verging recumbent folds and covered by a Late Triassic unconformity indicate that the SE  
243 China coastal area also experienced a Middle Triassic deformation (Zhu et al., 1996).

244

## 245 **6. Discussion of the Triassic orogens**

246 A N-directed Triassic oceanic subduction, below the SCB, is often suggested (e.g.  
247 Zhou and Li, 2000; Li and Li, 2007). This view is based on the assumption that the active  
248 continental margin of SCB existed since the Middle Permian (Li et al., 2006, 2012). Indeed,

249 an active margin setting has been documented for the Cretaceous, but the geochemistry of the  
250 Jurassic magmatism supports rather an intraplate setting (Chen et al., 2008). As in Vietnam, in  
251 Hainan, the relative positions of the mélangé and arc argue for a South-directed subduction. In  
252 SE China, most of the Late Triassic plutons are S-type due to the melting of Proterozoic  
253 sediments, and a small amount of A-type plutons also exists (e.g. Li et al., 2006; Chen et al.,  
254 2011; Sun et al., 2011; Zhao et al., 2012; Wang et al. 2013). The tectonic setting of these  
255 plutons is not documented. Furthermore, their emplacement ages do not clearly show a NW-  
256 to-SE polarity that might be related to a N-directed subduction.

257 Therefore, an alternative interpretation is tentatively proposed here. The NW-directed  
258 shearing and 300 km shortening recorded by the sedimentary series of the Xuefengshan Belt  
259 are balanced by the same amount of continental subduction. This means that during the  
260 Triassic, the SE China lithosphere was underlain by a slab corresponding to the SE-ward  
261 subducted lithosphere of the Western part of SCB (Figs. 6,7).

262 Along the SE China coast, evidence for a Triassic subduction is not documented.  
263 Assuming an eastward extension of the Jinshajiang-Ailaoshan-N Vietnam-Hainan belt would  
264 imply that the SCB represents the lower plate. Such a polarity may account for the thrusting  
265 sense observed in Yunkai, Hainan, and SE China. The Triassic peraluminous plutons (e.g.  
266 Darongshan granite, DS in Fig. 2) emplaced in the footwall of the major thrust zones during  
267 deep-seated thrusting coeval with melting. Moreover, Permian arc magmatism is documented  
268 in Mindoro Island of W. Philippines (Fig. 1; Knittel et al., 2010). Considering the Cenozoic  
269 opening of the S. China sea, this arc represents the eastern extension of the Wuzishan arc of  
270 Hainan. Triassic ophiolites and tectonics are unknown in the Philippines, but the Tailuko belt  
271 of Taiwan that exposes the deepest rocks of the island yields garnet-chloritoid-kyanite-  
272 staurolite micaschist with metamorphic zircon dated at  $200 \pm 22$  Ma (Yui et al., 2009; Fig.  
273 2). Furthermore, HP metamorphic rocks crop out in the S. Ryukyu Islands (Fig.2). In these

274 mafic schists, phengite and barroisite are dated at  $225\pm 5$  Ma and  $237\pm 6$  Ma, respectively  
275 (Faure et al., 1988). One possibility is to relate these features to the Triassic orogeny of SCB.

276 In conclusion, the Triassic belts that wrap around the SCB southern margin from SW  
277 to SE exhibit lithostratigraphic, structural and chronological resemblances that allow us to  
278 infer that a single belt developed in response to the subduction and collision of the SCB below  
279 the Qiangtang-Indochina block. Such a S-directed subduction was coeval with the intra-  
280 continental subduction responsible for the development of the structures in SE China. Work in  
281 progress aims at testing this new interpretation.

282

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- 580
- 581
- 582 Figure Captions
- 583
- 584 Fig. 1. Schematic map of Central-Eastern Asia showing the main continental blocks,  
585 ophiolitic sutures and faults. SCB: South China Block, D: Dabieshan, XFS: Xuefengshan,  
586 RRF: Red River Fault, LMS: Longmenshan. Pink lines denote the Triassic belts discussed in  
587 this paper. Diamond in Mindoro Island locates the Permian magmatic arc.
- 588

589 Fig. 2. Tectonic map of the South China Block with emphasis of the Triassic events. **The light**  
 590 **pink area represents the Xuefengshan belt.** RRF: Red River Fault, SCS: Song Chay suture,  
 591 SMS: Song Ma suture, CLF: Chenzhou-Linwu fault, MXT: Main Xuefeng Thrust, JSF:  
 592 Jiangshan-Shaoxing fault, DBF: Dien Bien Fu fault. NEV: NE Vietnam belt, DNCV: Day Nui  
 593 Con Voi Triassic arc, DS: Darongshan pluton, SB: Shiwandashan Mesozoic basin. **The cross**  
 594 **sections (Fig. 2A, B, C) are located.**

595

596 Fig. 3. Crustal scale cross sections of the Triassic belts

597 A: NW Vietnam-S China profile (simplified from Faure et al., 2014). B: Hainan profile. C:  
 598 Yunkai profile.

599

600 Fig. 4. Field pictures of the Triassic belts. A: Late Triassic red beds unconformably overlying  
 601 subvertical Middle Triassic turbidite (Jinshajiang, E. of Dexing).

602 B: Bedding (S0) and cleavage (S1) relationships in Middle Triassic limestone indicate a NE-  
 603 verging fold. A down-dip stretching lineation is observed in the S1 surface (Ailaoshan). C:

604 Permian limestone overthrusting Middle Triassic turbidite (S. Guangxi). D: Early Paleozoic  
 605 porphyritic granite deformed as orthogneiss with top-to-the-N shearing (Yunkai massif). E:

606 N-verging fold in Devonian sandstone, in the footwall of the Yunkai thrust (Luoding). F:

607 Carboniferous limestone olistolith in a Permian-Triassic siltite matrix (Hainan).

608

609 Fig. 5. Crustal scale cross section of the intracontinental Xuefengshan belt (modified from

610 Chu et al. 2012a). Folding and shearing, pre-dated by the emplacement of Late Triassic

611 plutons accommodated the SE-ward underthrusting of the Western part of the SCB below its  
 612 Eastern part. S1, S2, S3 are the cleavage planes related to the Triassic deformation phases (cf

613 Chu et al., 2012a for detail).

614

615 Fig. 6. Lithosphere scale interpretative cross section from the Xuefengshan to the SE coast of  
616 SCB depicting the Triassic deformation. The Early Paleozoic and Cretaceous events have  
617 been omitted for clarity. The Triassic geodynamics of the S. part of the SCB are interpreted as  
618 the consequence of intracontinental subduction in the Xuefengshan and collision of the SCB  
619 with a continental block equivalent to Indochina presently hidden below the S. China Sea.  
620 Evidence for a magmatic arc is documented in Hainan Island and in W. Philippines.

621

622 Fig. 7. Schematic map showing the main Triassic tectonic features of the South margin of the  
623 SCB. At variance with the previous interpretations, this cartoon emphasizes the southward  
624 continental subduction of the SCB below the Indochina Block and its eastward extension in  
625 W. Philippines that was located South of the SCB before the opening of the South China Sea.  
626 Collision was preceded by oceanic subduction that gave rise to several magmatic arcs,  
627 namely: W. Ailaoshan, Sam Nua, Dai Nuy Con Voi, Wuzishan, Mindoro. JSJ: Jinshajiang  
628 suture, AS: Ailaoshan suture, SMS: Song Ma suture, SCS: Song Chay suture, HS: Hainan  
629 suture. Terrigenous deposits of the Shiwandashan basin (SB) unconformably cover the folds  
630 and thrusts of the Middle Triassic Youjiang basin. The intracontinental Xuefengshan Belt  
631 developed in response to the SE-ward continental subduction of the basement of the SCB.  
632 MXT: Main Xuefengshan Thrust. Dotted lines represent the fold axes. The Triassic E-W to  
633 NE-SW striking folding developed in the Neoproterozoic Jiuling Massif corresponds to a  
634 dextral ramp of the Xuefengshan belt. The Triassic plutons have been omitted for clarity.

Figure 1  
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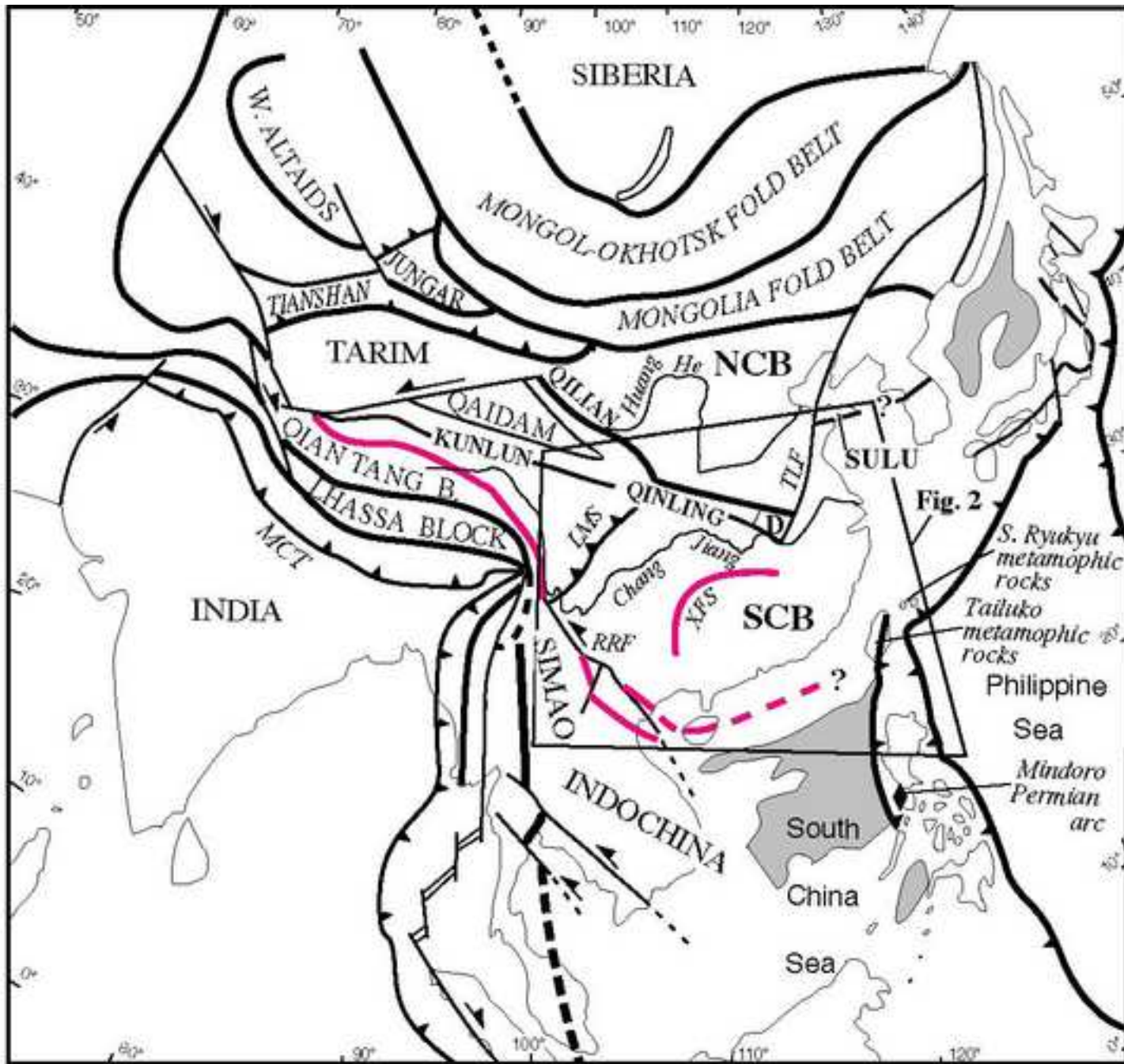


Fig. 1



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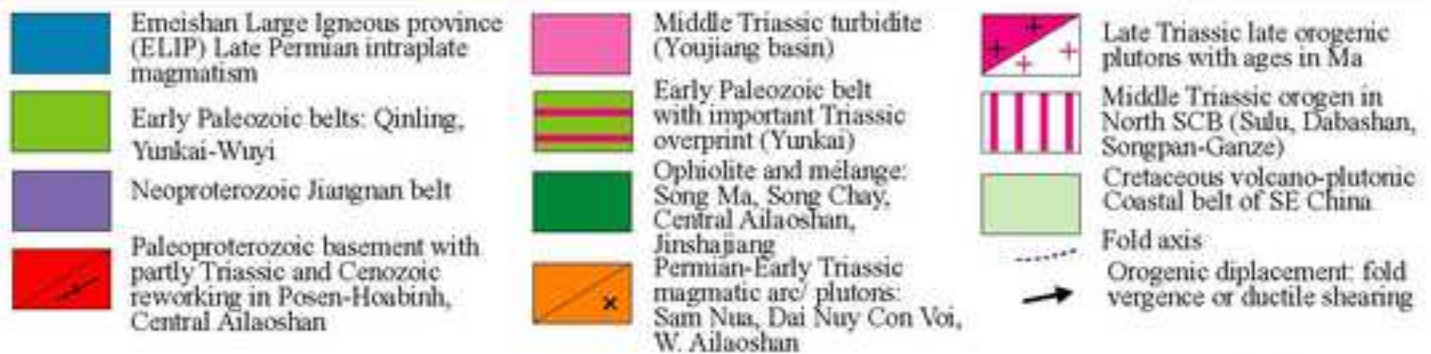
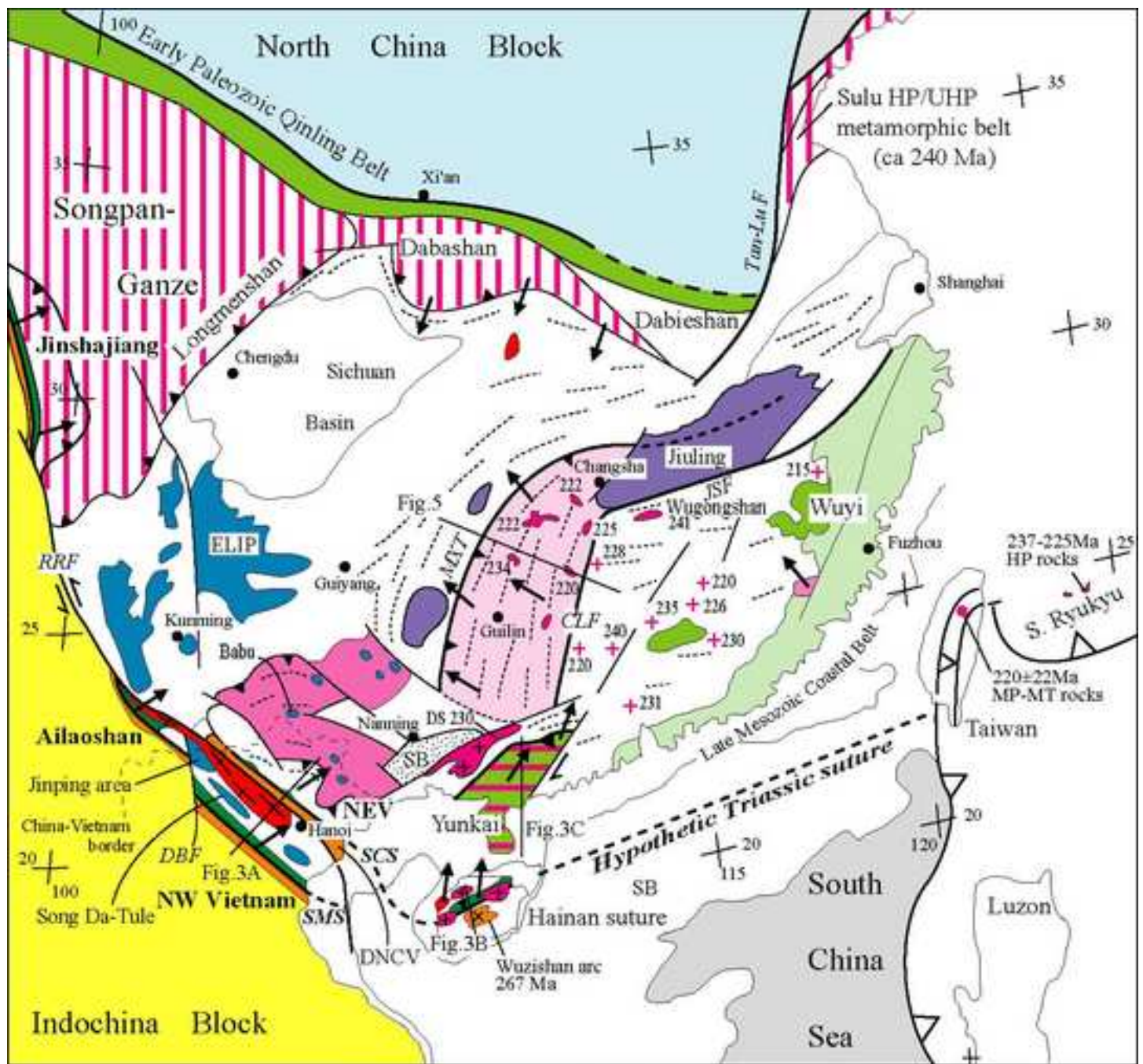


Fig. 2

Figure 3  
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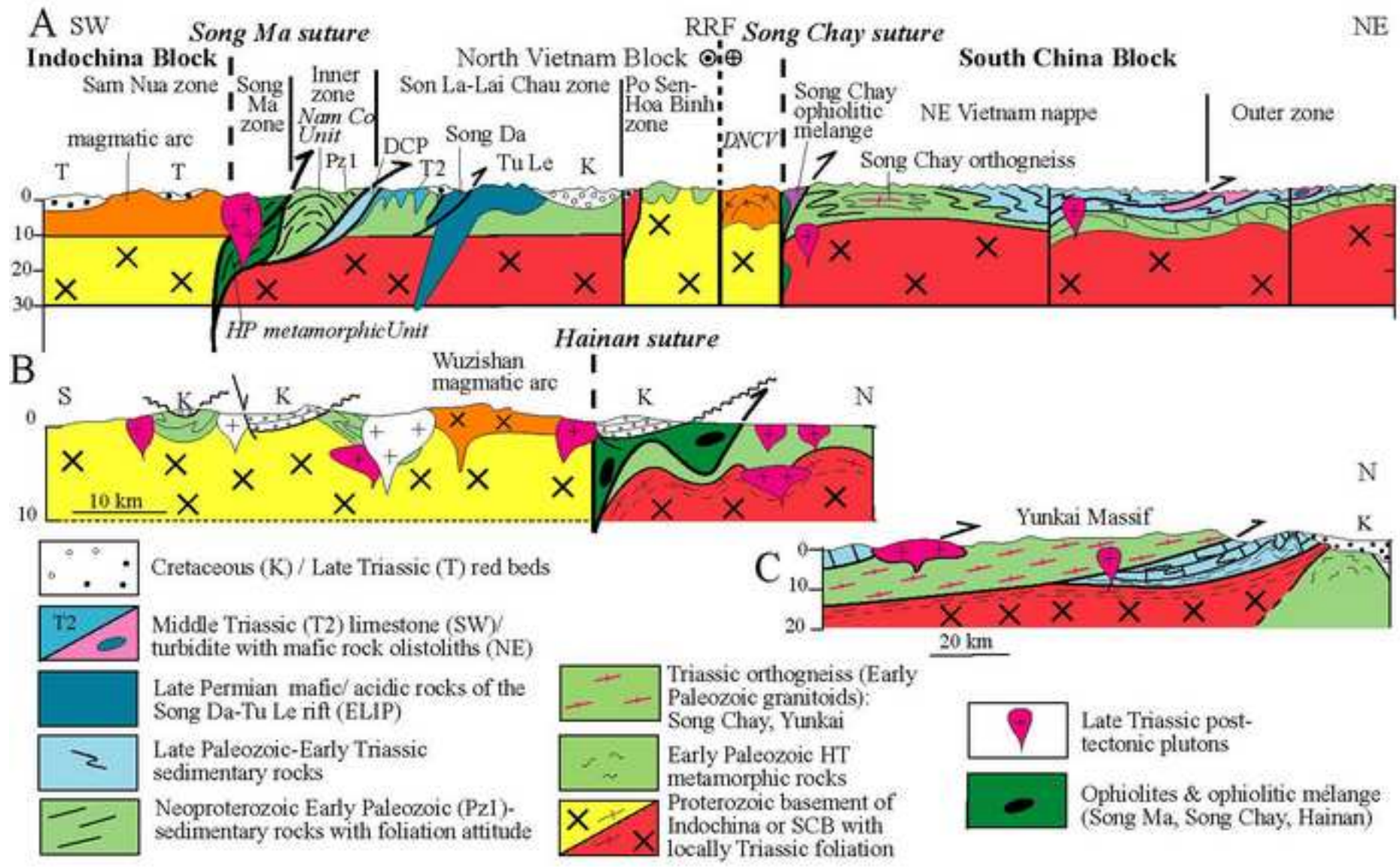


Fig. 3



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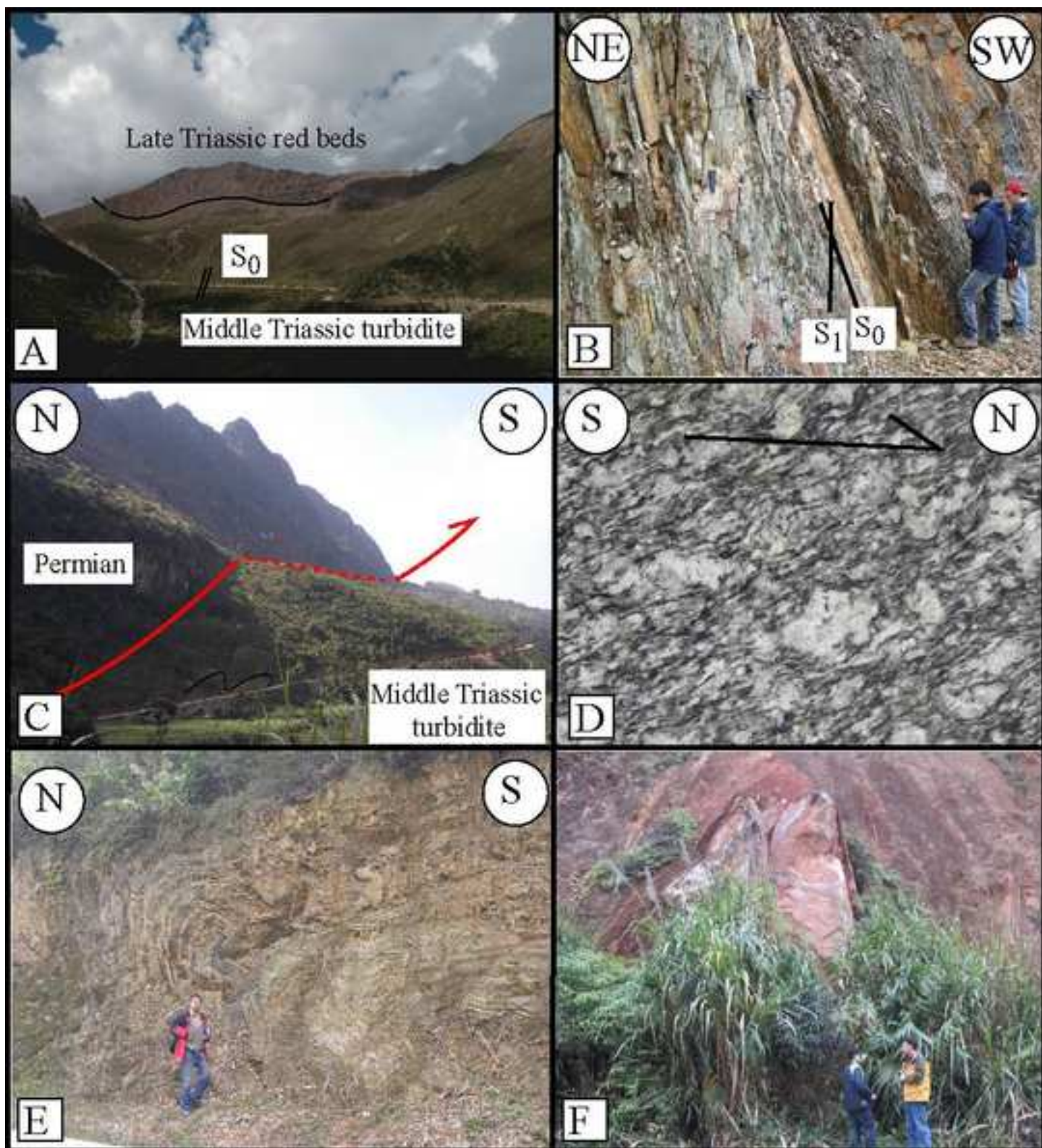


Fig. 4

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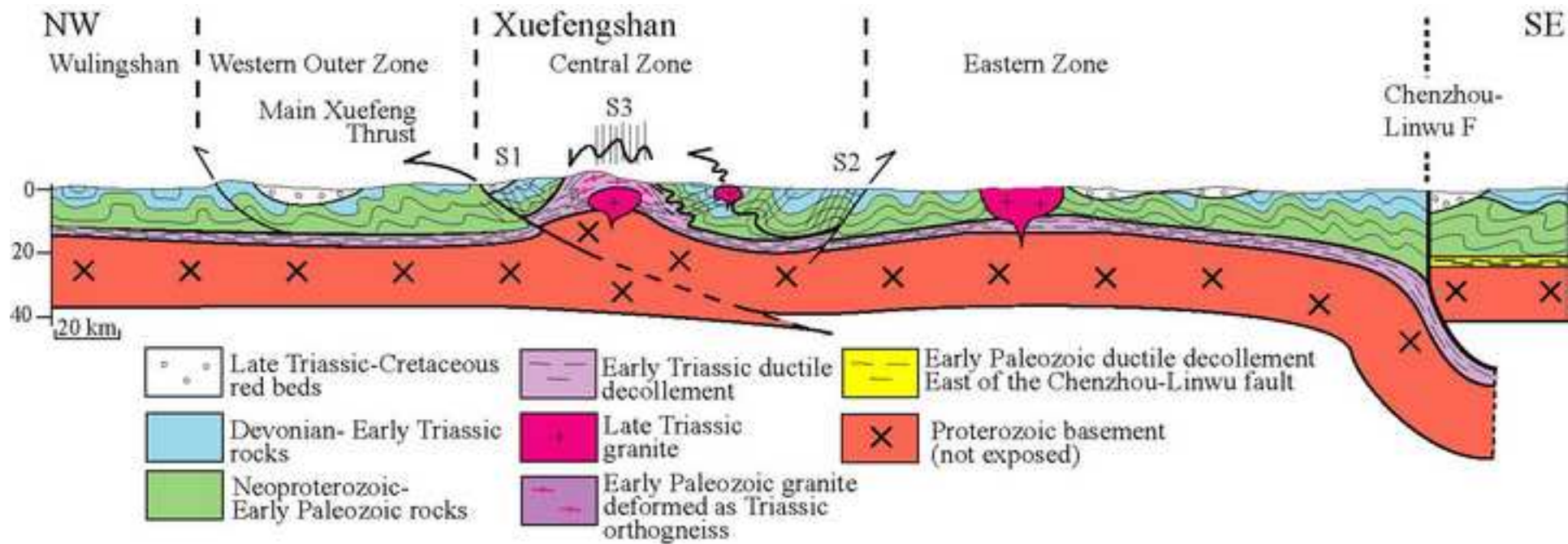


Fig 5



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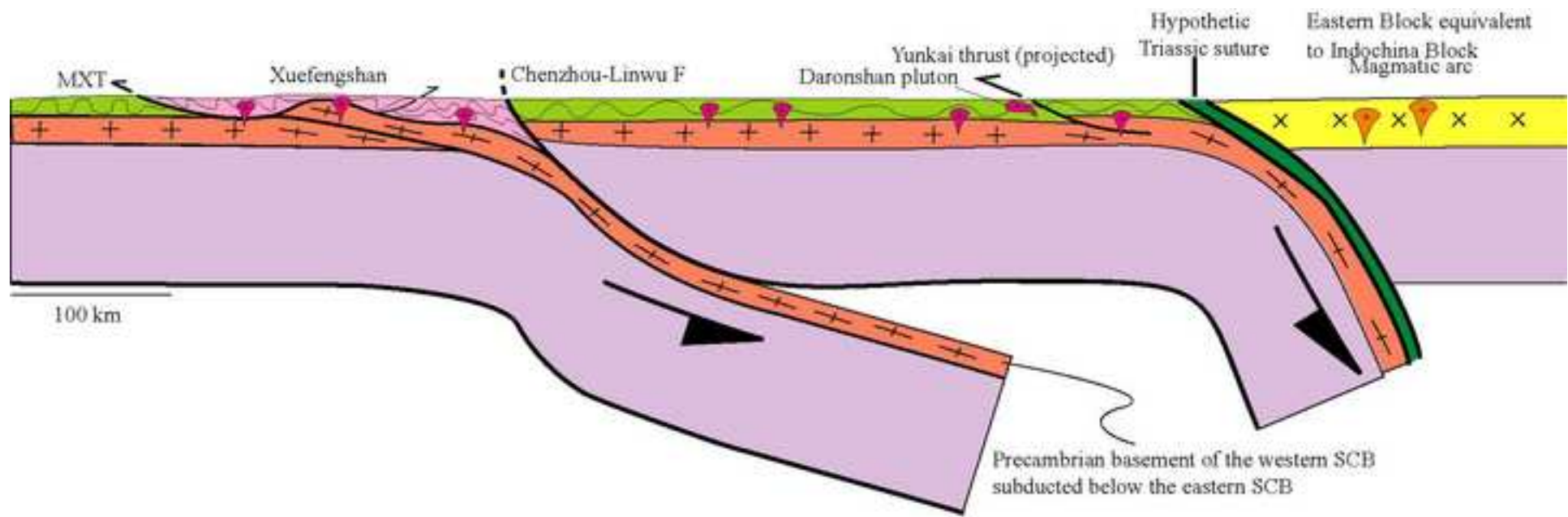


Fig. 6

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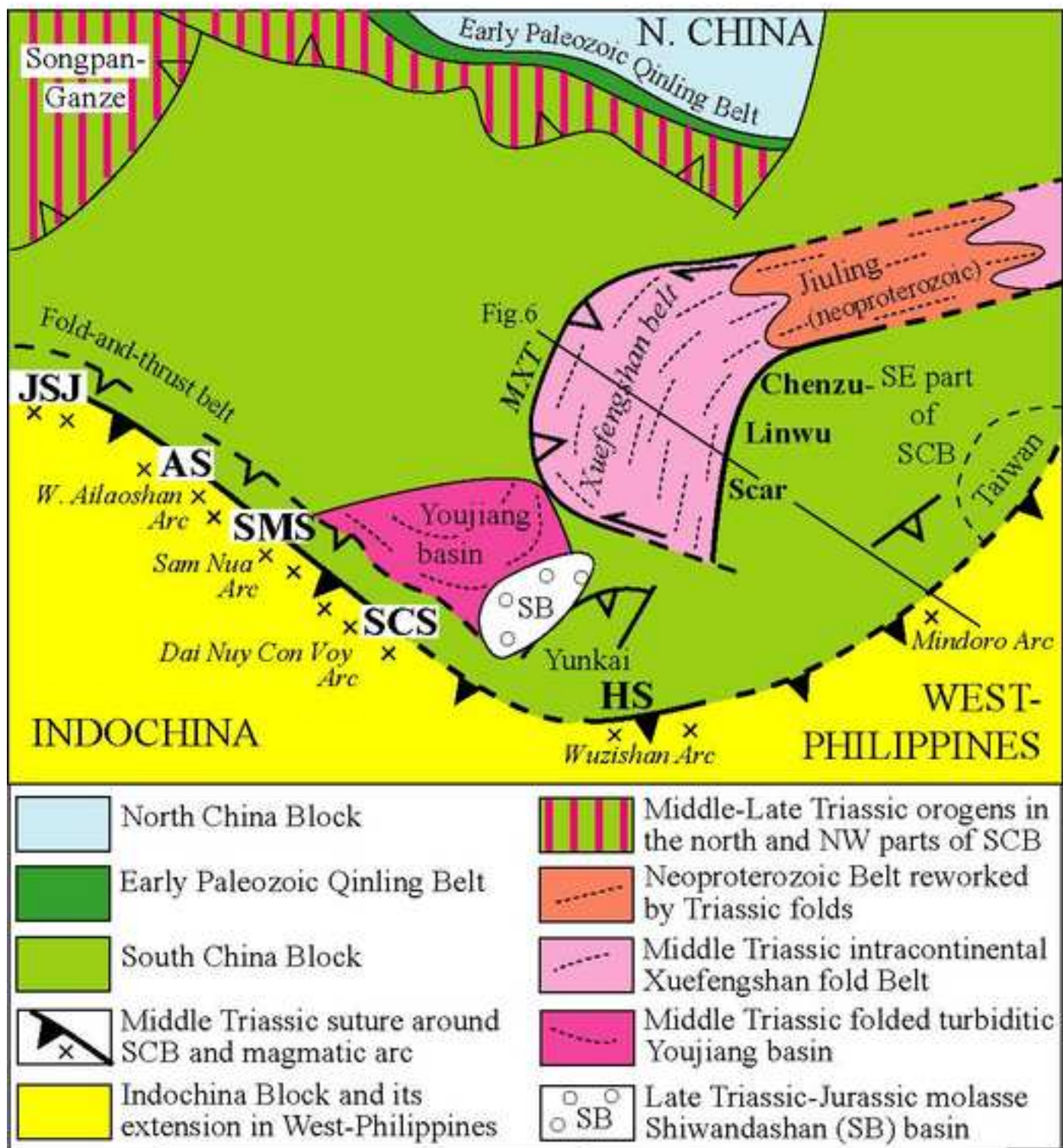


Fig.7