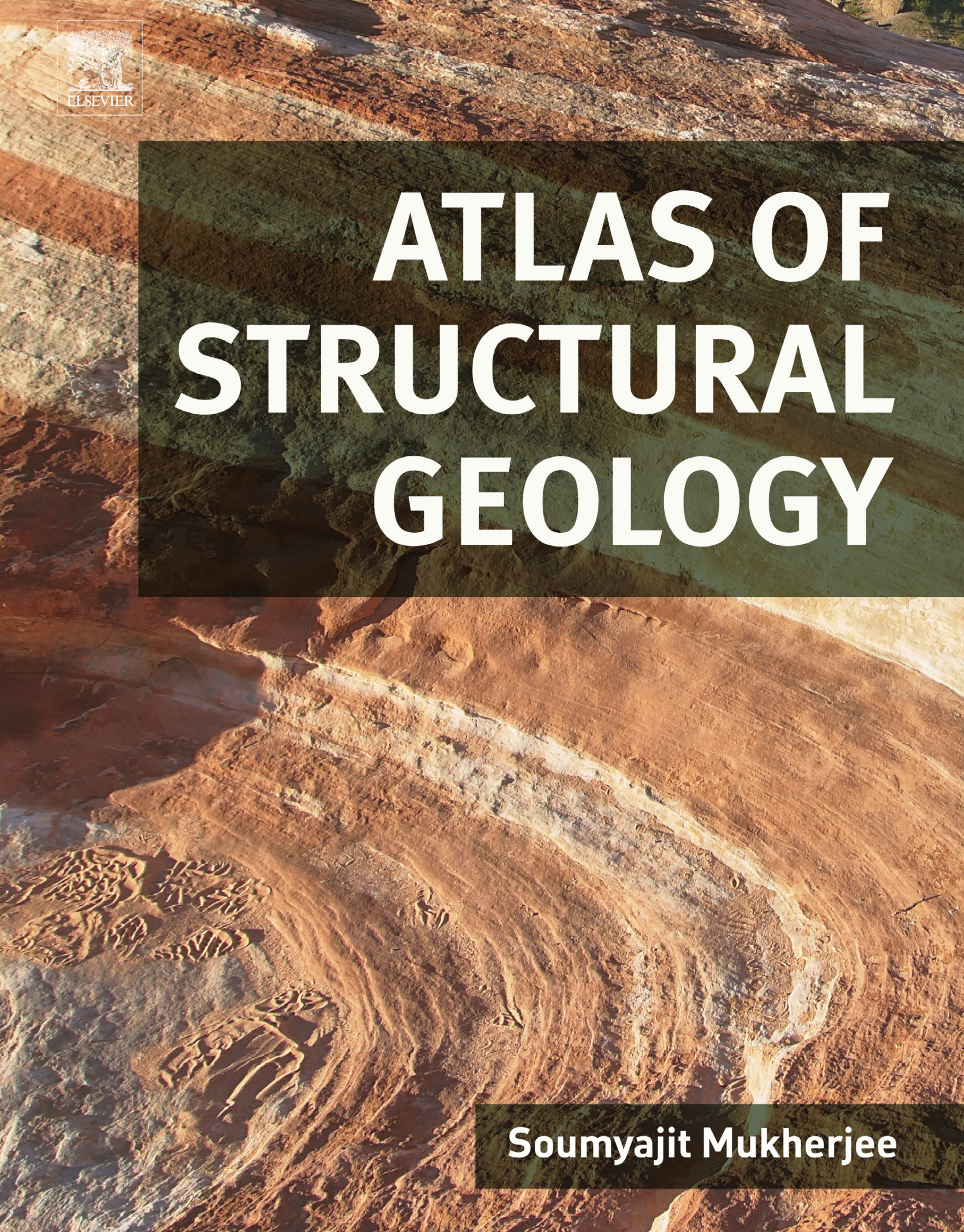

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ATLAS OF STRUCTURAL GEOLOGY

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Atlas of Structural Geology

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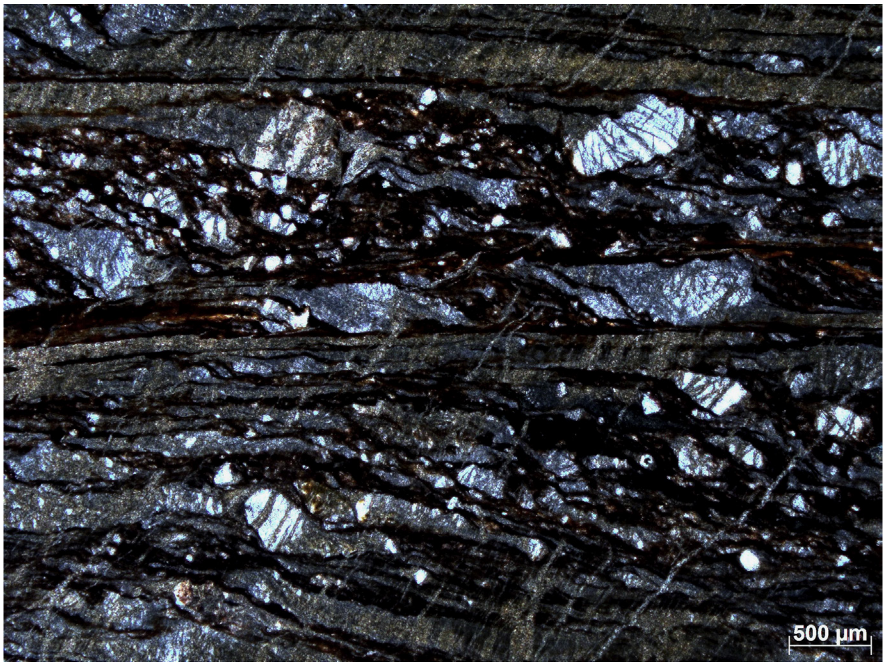

FIGURE 2.34 Sigma clasts, S-C structures in soft-sediment. Microstructures in ~1-m thick clastic infill of a steeply dipping synsedimentary fault displaced Mesozoic rocks. Compositional bands in clastic infill parallel the fault. The major structures: calcite shear veins correspond to stacked slickenside fibers which occur along minor faults within the infill and parallel to main fault. Calcite fibers alter with millimeter-thick bands of clastic sediment (quartz and chert grains, clays with iron impregnation). Sigma clasts with calcitic tails indicate top-to-left shear. The quartz grains within the sigma clasts are intensely fractured and extended by calcite veinlets, which are also consistent with sinistral shear. In the lower part, parallel iron-impregnated dark clays bands correspond to S-foliation planes and merge with C-shear surfaces parallel to calcitic shear veins. Thus ductile S-C structure (Platt and Vissers, 1980) is defined. All these features are geometrically similar to structures found in crystal-plastically deformed metamorphic rocks. However, the sediment infill and host rocks are unmetamorphosed and were never buried below 2 km. The interpretation is that the structures formed in unconsolidated state of the clastic infill, during the burial path of the sediment. The whole deformed zone is crosscut by the youngest parallel set of calcite veinlets, which could form after the complete diagenesis of the shear zone rocks. Middle Eocene sandstone, siltstone. Location: Vöröshíd quarry, Tardos village, Gerecse Hills, Hungary. Coordinates: 47°41′48.47″N, 18°26′56.25″E. *(László Fodor)*

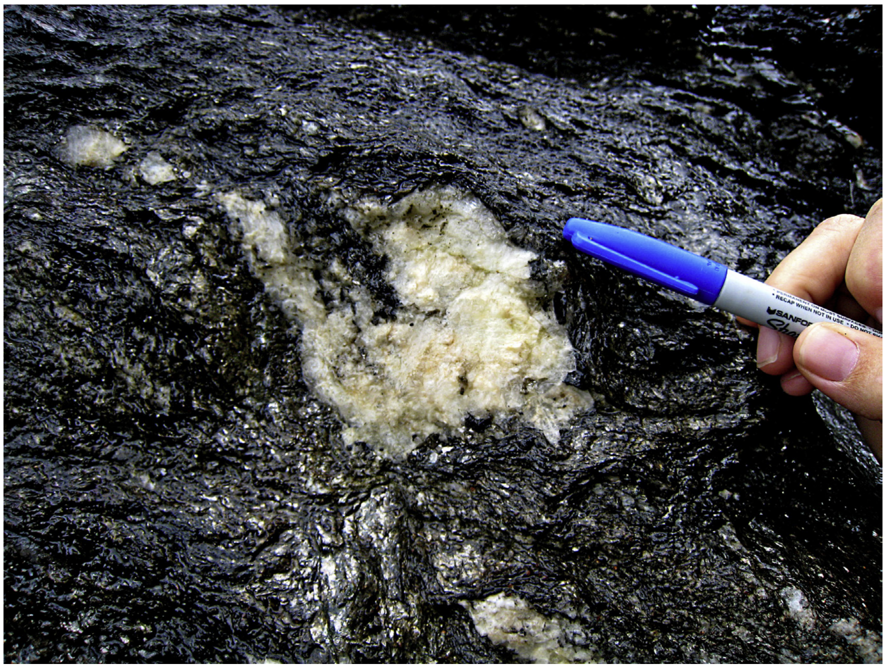

FIGURE 2.35 A top-to-left ductile sheared sigmoid quartz lens in kyanite-garnet gneiss, hanging wall rock of the Main Central thrust. Location: Unit I, Greater Himalaya, Kali-Gandaki section, Central Nepal Himalaya. *(Subodha Khanal)*

FIGURE 3.20 **A N-dipping subvertical fault plane cut across quartzite pebble.** Siwalik Supergroup conglomerate. Such a faulting indicates possibly an isostatic adjustment. Top-to-S (up) brittle shear. Near Mohand, Roorkee–Dehradun transect. 30°14.038′N, 77°56.9′E. Uttarakhand, India. *(Dripta Dutta)*

FIGURE 3.21 **Along-dip segmented normal fault and fault-related fold in Jurassic sequence.** Three fault segments dissect the condensed pelagic Jurassic sequence: one single planar plane in the lower part, two in the Tölgyhát Formation, one above the lower segment and one to the left (Sasvári et al., 2009). This disposition is typical for along-dip segmented normal faults (Childs et al., 1996; Rykkelid and Fossen, 2002). Between segments the deformation accommodated in the thin marlstone unit. The upper marlstone layers show folding between fault segments. The lower gray clay layers are boudinaged/pinched along the lower fault segment. Note the hanging wall part is present in the shadow of the marlstone layers. This different behavior could occur because of contrasting rheology of the deforming rocks. The segmented fault can have Middle Jurassic age (Bathonian, 168–166 Ma) because at least one upper segment is covered by Middle to Late Jurassic (Callovian–Oxfordian) radiolarite beds (Fodor et al., 2013). This early formation time matches with folding of the Toarcian unit, which deformed before complete diagenetic cementation, still in a semiplastic stage. The E-W-trending fault accommodated minor extension of a downbending side of a foreland basin opposite to the growing Dinaridic orogen (Fodor et al., 2013). Blue rucksack: ~50 cm. Early Jurassic limestone, late Early Jurassic (Toarcian) marlstone-claystone, Middle Jurassic nodular limestone of Tölgyhát Formation. Location: Tölgyhát quarry, Lábatlan village, Gerecse Hills, Hungary. Coordinates: 47°43′20.92″N, 18°30′45.80″E. *(László Fodor)*

FIGURE 3.44 **Synlithification faults in Cretaceous clastics.** In the gray marl, the centimeter-thick sandstone layers commonly contain a set of small, parallel displacement zones, which cannot be followed up to the next sandstone bed. Within the sandstone, the fault planes are frequently not discrete surfaces and are macroscopically invisible. They either do not continue in the intercalating marlstone or occur as closed fractures. In addition, displacement lines at the upper and lower boundaries of the sandstone bed are not always aligned but are en-echelon along dip direction. This can be interpreted as along-dip segmented fractures. Displacement can be smaller at the upper than at the lower bedding plane. All these deformation features developed when sandstone beds consolidated/cemented partly and were in plastic state so they are synlithification faults. The deformation can be regarded as a first step for boudinage. Deformation occurred during the Early Cretaceous progressive burial. Compaction affected the conjugate fracture set and increased their angle to obtuse angle. Postdeformation cementation sealed the early displacement features. The deformation is related to an Early Cretaceous foreland basin formation (Tari, 1994; Fodor et al., 2013). Green eraser: ~ 2 cm. Early Cretaceous (Valanginian) marlstone, sandstone (Fogarasi, 1995). Location: Bersek quarry, Lábatlan village, Gerecse Hills, Hungary. Coordinates: 47°43′20.33″N, 18°31′29.13″E. *(László Fodor)*

FIGURE 3.45 **The outcrop exposes one of the main faults of the active Hronov-Poříčí Fault Zone, Czech Republic.** It is ~70-km long intraplate zone responsible for earthquakes up to M~4.7 recently (Woldrich, 1901; Špaček et al., 2006). Red-brown Permian conglomerates and breccias of the Trutnov Formation on the right side form hanging wall of the fault zone. Conglomerates are overlain unconformably by ochre to dark gray Cretaceous sandstones and siltstones of the Peruc-Korycany Formation, cropping out on left side of the wall (see Novakova, 2014). The dip of both the Permian and the Cretaceous sediments is steep (up to 89° SW) due to the close vicinity of the main fault line. The Hronov-Poříčí Fault Zone represents main reverse fault accompanied by parallel/oblique normal or reverse faults (Valenta et al., 2011). GPS coordinates: N50°32′14″, E016°02′31″. *(Lucie Novakova)*

FIGURE 4.12 Asymmetric rotating domino boudins within low-grade metamorphic carbonate sequence. The domino boudins are made up of dolomite, while the surrounding rock is calcite marble. At low-grade conditions, dolomite intercalations act as more competent layers. The calcite marble deforms crystal plastically forming foliated calcite mylonite. The intercalated dolomite layers remain nearly rigid and disrupt into rectangular boudins. Rectangular shape of the dolomite dominos indicates high viscosity contrast during deformation (Fossen, 2010). The domino boudins are asymmetric ones and parallel mylonitic foliation. The individual dominos are separated by small-scale shear zones that die out as soon as they leave the dolomite layer. Some dilatation occur across the inter-boudin surfaces. Significant rotation of the domino boudins are present, which kept the row of boudins aligned with the general foliation of the calcite mylonite. The stretch magnitude varies along the boudin layers, but usually remains low. Rarely domino boudins separate completely. Asymmetric domino boudins indicate sinistral shear. Other shear criteria in field confirmed this. However, asymmetric boudins can be problematic shear-sense indicators (Goscombe and Passchier, 2003), thus require additional studies. Triassic limestone and dolomite (Schefer et al., 2010). Photo width ~20 cm. Brzeće, Kopaonik Mts., SE Serbia. Coordinates: N43°18′ 44.05″, E20°50′59.75″. *(László Fodor)*

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Preface

Documentation of structures in different scales is the first step in many structural geological studies. This edited atlas gives an overview of diverse structures. Due to lack of space or inappropriateness, sometimes interesting structural snaps cannot be published in journals. This book fills that gap.

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