

The Structure of the 1985 Tibet Geotraverse, Lhasa to Golmud: Appendix. Structures and Fabrics in the Kunlun Shan: Evidence for Mid-Palaeozoic (Pre-Upper Devonian) Deformation

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APPENDIX. STRUCTURES AND FABRICS IN THE KUNLUN SHAN: EVIDENCE FOR MID-PALAEOZOIC (PRE-UPPER DEVONIAN) DEFORMATION

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For the purpose of this discussion, three tectonic units referred to as the North Kunlun, South Kunlun and Bayan Har Units, separated by the Middle Kunlun and Xidatan Faults, are distinguished (figure A 1).

1. THE NORTH KUNLUN UNIT

In the North Kunlun Unit, an angular unconformity between pre-Upper Devonian metamorphic rocks (Binggou Group) and unmetamorphosed Upper Devonian is recognized in the Daobangou Valley, about 35 km S 10° E from Golmud (see Yin *et al.*, this volume, figure 2). The underlying series, of quartz mica schists, quartzite and marble, shows a steeply

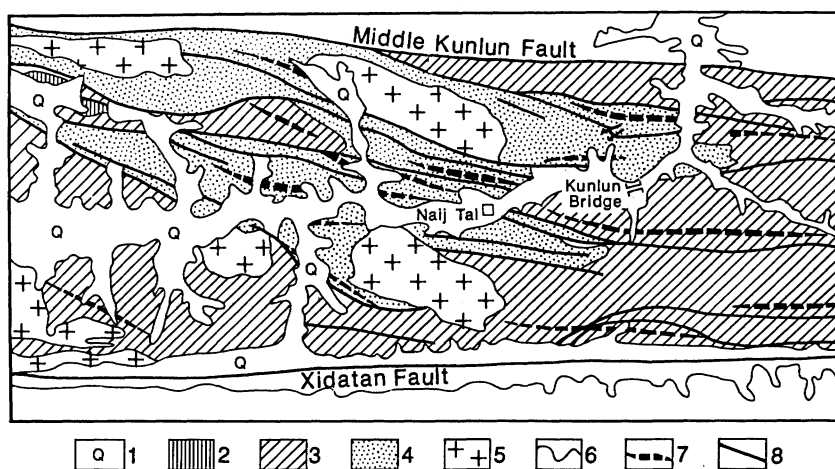


FIGURE A 1. Structural lines in the South Kunlun Unit. 1 (Q): Quaternary. 2: Neogene. 3: Upper structural stage (Carboniferous to Triassic). 4: Lower structural stage (Precambrian to Ordovician). 5: Granitic rocks. 6: Geological boundary line. 7: Axial trace of fold. 8: Compressional fault. 9: (MKF) Middle Kunlun Fault. 10: (XF) Xidatan Fault. 11: Naj Tal. 12: Kunlun Bridge.

northward-dipping schistosity and complex transposed folds. The overlying sequence, mapped as Upper Devonian but here unfossiliferous, with a basal conglomerate over 100 m thick, dips regularly southwards at a moderate angle. The conglomerate contains well-rounded pebbles of igneous and metamorphic rocks including marble, gneiss, quartzite, granite, sericite schist and amphibolite. The abundant marble pebbles are lithologically similar to the marble in the underlying sequence. According to published information (Wang *et al.* 1983; 1:1.5 M Geological Map of Qinghai–Xizang Plateau 1980), these metamorphic rocks extend at least 700 km in an east–west direction.

† The author was unable, owing to ill health, to participate in the 1985 Geotraverse, but took part in preparatory work before 1985.

2. THE MIDDLE KUNLUN FAULT

The Middle Kunlun Fault is taken to separate the North and South Kunlun Units. It dips steeply southwards. A cleavage zone several hundred metres wide on the north side of the fault indicates sinistral displacement, combined with south side up. The fault can be traced far to the east and west of the traverse area; to the east, some ultramafic masses and pillow lavas have been found in this zone.

3. THE SOUTH KUNLUN UNIT

In this unit, the Upper Trias Babaoshan Group overlies metamorphosed Middle Triassic and older rocks with an angular unconformity. No definite field evidence of either an end-Permian or a mid-Palaeozoic unconformity has yet been seen: they are inferred on indirect evidence and are thought to have been obscured by the end-Triassic deformation and metamorphism which became increasingly intense southwards.

Fabric elements which have been studied include schistosity, lineations (mineral lineations, intersection lineations, fold axes, quartz lenses). The attitudes of the lineations in the older rocks (Ordovician and Precambrian (?)) differ from those in the Upper Palaeozoic and Triassic: in the older rocks, they plunge steeply, in the younger, gently (figure A 2). A few steeply-plunging minor folds are seen in the Ordovician (Naij Tal Group), whereas in the Carboniferous and Triassic, the fold axes plunge gently [but note steep westerly plunge of Carboniferous Red Beds immediately south of the Middle Kunlun Fault – Ed.].

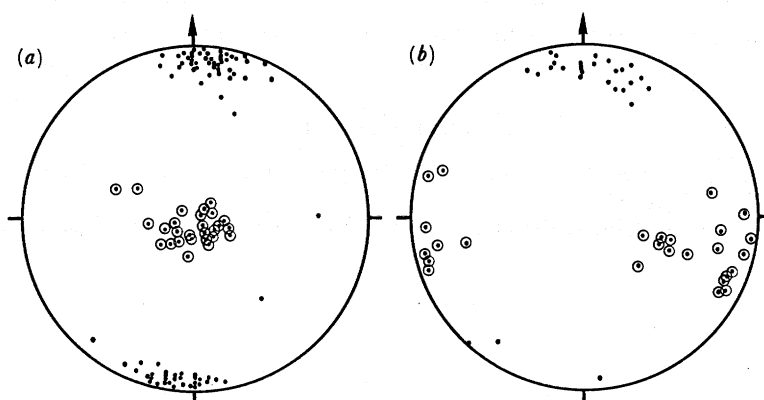


FIGURE A 2. Projections (equal area net) of poles to schistosity (dots) and lineation (circles round dots). (a) Lower structural stage (Precambrian to Ordovician; (b) Middle structural stage (Carboniferous to Triassic). South Kunlun Unit.

The schistosity in the older (Lower Palaeozoic) and younger (Carboniferous to Triassic) rocks are superficially similar but detailed microscopic study shows two schistosity in the older rocks but only one in the younger. In thin sections, in some of the older rocks (e.g. a schistose greywacke from west of Kunlun Bridge) it appears that an early schistosity is defined by shape-orientation of classic grains and by a penetrative mica fabric, while a later fabric, at an angle to the first one, is defined by mica in discrete planes. In such cases, it is only the later schistosity that is seen in the field. These two schistosity have not been seen in the younger rocks. The earlier one is inferred to be pre-Carboniferous. Oriented thin sections show that the early schistosity tends to strike WNW, with a steep southward dip, while the later one strikes

east-west, also dipping steeply. The intersection between them, in the older rocks, plunges steeply.

4. THE XIDATAN FAULT

This separates the South Kunlun and Bayan Har Units. It extends for over 1000 km east-west. Numerous microscopic features show that the sinistral shear was combined with a north-side up displacement. The fault dips northwards. (See Kidd & Molnar, this volume, for more details.)

5. THE BAYAN HAR UNIT

In this unit, the prevailing rocks are assigned to the Triassic Bayan Har Group of slates and turbidites. In them, south of the Xidatan Fault, the schistosity dips northwards and early lineations are subhorizontal, but farther south around Wudaoliang the schistosity dips southwards.

6. TECTONIC INTERPRETATION

The structural and other evidence is considered to indicate that the North Kunlun, South Kunlun and Bayan Har Units represent separate terranes or microplates, separated by the Middle Kunlun and Xidatan Faults which are thought to represent or conceal sutures. These are believed, from attitude of schistosity, distribution of calc-alkaline volcanics and sedimentation, to follow northward subduction. The northerly of the two supposed sutures is thought to mark the closure of a backarc basin in the late Permian; the southern one, along the Xidatan Fault Zone, is thought to have closed in the late Triassic.

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