三、西大滩活动断裂与古地震

西大滩活动断裂（F_6）属昆仑山走滑断裂的重要组成部分，发育于东大滩—西大滩盆地南部，位于昆仑雪山北侧，西起大红石沟，向东经巴拉大才曲沟头、惊仙谷沟口、西大滩、东大滩，东达秀沟盆地南侧，全长约 250km，在东西两端分别与库赛湖断裂、阿拉克湖断裂呈左阶斜列复合；显著控制东大滩谷地和西大滩谷地的空间分布。

在昆仑山南部西大滩与东大滩谷地，沿西大滩活动断裂（F_6）发育大量古地震遗迹，包括不同类型的地震破裂、地震鼓包、地震楔、地震陡坎和小型拉分盆地，以串珠状斜列地震鼓包最为显著。在西大滩—东大滩盆地，通过开挖 10 个探槽，沿西大滩活动断裂（F_6）鉴别出全新世 4 期地震鼓包和 4 期古地震楔，对应于全新世 4 期古地震事件。经过光释光、热释光和 ^{14}C 同位素测年，确定全新世 4 期古地震事件的发生时代分别为 10.0kaB.P.、8.6-8.7kaB.P.、7.0kaB.P.、6.1kaB.P.。结合同震位移观测资料，估算西大滩断裂全新世 10.0-8.7kaB.P.、8.6-7.0kaB.P.、7.0-6.1kaB.P.不同时期平均左旋走滑速率分别为 6.9mm/a、5.6mm/a、4.4mm/a；同震位移 9m 的大震间隔约为 1300-1600 年，同震位移 4m 的地震间隔约为 900 年。全新世晚期（≤5kaB.P.）沿西大滩活动断裂未发生 7.5-8 级强烈地震，与 Van der Woerd et al.（1998）的认识存在比较明显的差别。

PART 3 XIDATAN ACTIVE FAULT AND ITS PALEO-EARTHQUAKE RELICS

Xidatan active fault (F_6) of 250 km long is an important segment of Kunlun strike-slip fault. It starts from Dahongshi valley in west, trending eastward through head of Baladacaiqu River, Jingxiangu stream mouth, Xidatan valley, Dongdatan valley to south Xiugou valley, Juxtaposed with Kusaihu fault (F_7) and Alaghu fault at its west and east ends respectively and evidently controls formation and evolution of Dongdatan and Xidatan valleys.

A great deal of pressure ridges distribute along the Xidatan strike-slip fault in en-echelon pattern, accompanied by varieties of seismic fractures, seismic wedges, seismic scarps and pull-apart-basins in the Xidatan and Dongdatan valleys in south Kunlun Mts. of north Tibetan Plateau. Most pressure ridges show anticline deformation of Holocene and Late Pleistocene deposits in trench cross-section with anticline axis trending in 290°-300°. And an angle ranging from 15° to 20° exists between elongation of pressure ridge and major active fault, indicating sinistral strike-slipping of the Xidatan fault. Thermoluminescent (TL)，Photoluninescent (OSL) and ^{14}C isotopic dating were finished for samples from different parts of pressure ridges and seismic fractures along Xidatan strike-slip fault. Accoding to TL and OSL dating, 4 intense earthquakes occurred and 4 stages of pressure ridges formed in 10.0ka B.P., 8.6-8.7ka B.P., 7.0kaB.P. and 6.1kaB.P. in Early Holocene, corresponding to earthquake intervals of 1300-1700a and strike-slip rate of 6.9mm/a, 5.6mm/a and 4.4mm/a in 10-8.7kaB.P., 8.6-7.0kaB.P. and 7.0-6.1kaB.P. respectively. Activity of the Xidatan strike-slip fault became weak since 5.0kaB.P., and strong earthquakes of Ms≥7.5-8.0 seem migrated southward from Xidatan fault to Kusaihu fault in Late Holocene. These facts are evidently different from data provided by Van der Woerd et al. (1998).

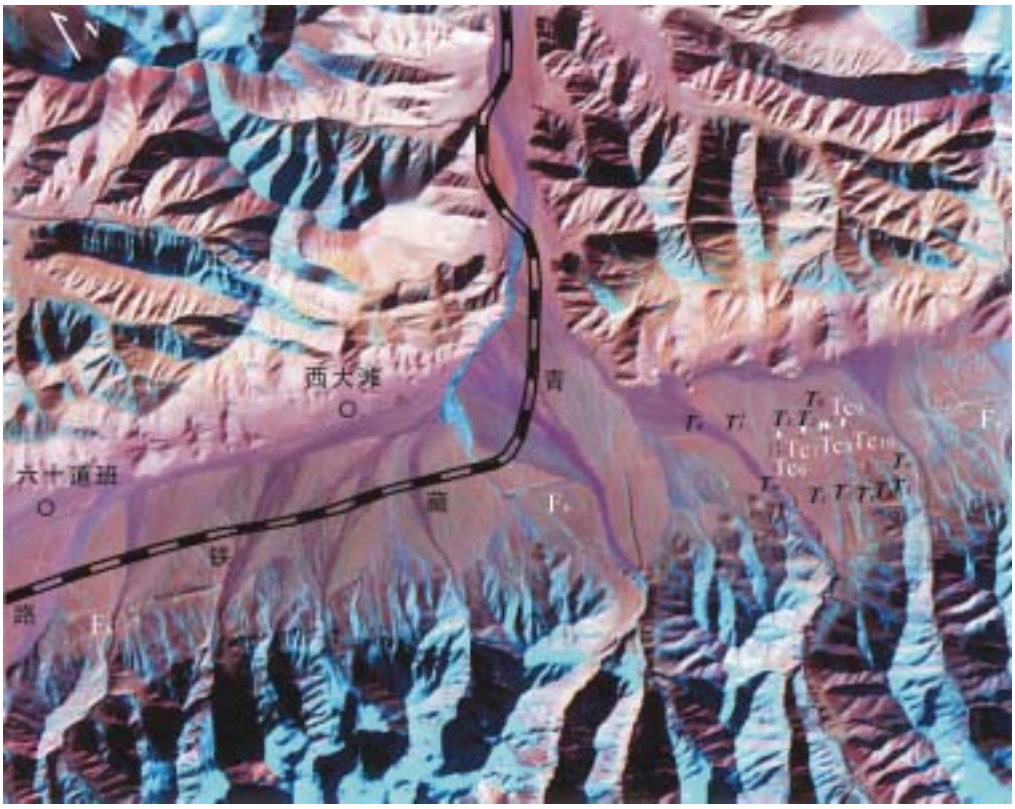


图 24 西大滩遥感影像图

（T_0~T_6 表示 I-VI 级阶地；Tc_6~Tc_{10} 表示探槽位置；F_6 为西大滩走滑断裂）

Fig.24 Remote sensing image of Xidatan valley and strike-slip fault (F_6) marked with terraces T_0~T_6 and trenches Tc_6~Tc_{10}



图 25 东大滩盆地构造地貌特征

（镜头向东）

Fig.25 View eastward at tectono-geomorphic features of the Dongdatan valley



图 26 东大滩沿断裂串珠状斜列分布的地震鼓包群

（镜头向南西）

Fig.26 View southwestward at en-echelon pressure ridges along Xidatan strike-slip fault in Dongdatan valley



图 27 东大滩地震鼓包沿走滑断裂线性分布

（镜头向西）

Fig.27 View westward at en-echelon pressure ridges along Xidatan strike-slip fault in Dongdatan valley



图 28 西大滩 61 道班南侧地震鼓包

（镜头向北西，顶部开挖探槽 Tc_5）

Fig.28 View northwestward at pressure ridges with trench Tc_5 on the top in south of 61th station of the Highway



图 29 西大滩惊仙谷沟口斜列地震鼓包群

（镜头向东）

Fig.29 View eastward at pressure ridges along Xidatan strike-slip fault in north of Jingxiangu gully



图 30 东大滩地震鼓包与拉分盆地

（镜头向西）

Fig.30 View westward at pressure ridges and pull-apart basin along Xidatan strike-slip fault in Dongdatan valley



图 31 东大滩西部 T_2 阶地地震分支破裂及探槽 Tc_7 剖面

（镜头向北东，地震破裂错断晚更新世晚期暗灰色砂砾石层和全新世暗棕色含砾砂土层；地震破裂内地震楔的 OSL 年龄为 10.9kaB.P.）

Fig.31 View northeastward at trench Tc_7 perpendicular to branch seismic fracture in T_2 terrace separating Holocene dark brown sands and Late Pleistocene gray pebbles in west Dongdatan valley. Explanation: Pebble wedge filled in seismic fracture in 10.9kaB.P. according to OSL dating.

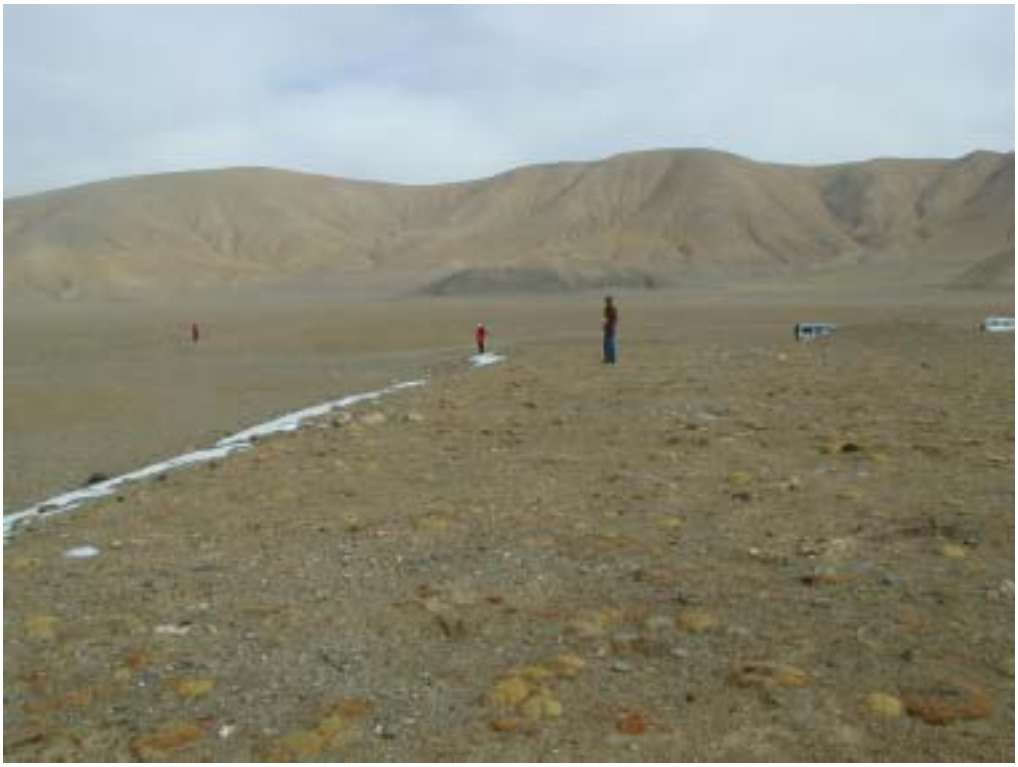


图 32 东大滩断裂左旋错断 II 级阶地 24m

（镜头向北）

Fig.32 View northward at 24m sinistral offset of T_2 terrace along Xidatan strike-slip fault in Dongdatan valley



图 33 东大滩断裂左旋错断冲沟 18m

（镜头向北）

Fig.33 View northward at 18m sinistral offset of stream along Xidatan strike-slip fault in Dongdatan valley



图 34 西大滩 60 道班南侧地震破裂左旋错断冲沟 27m

（镜头向南）

Fig.34 View southward at 27m sinistral offset of stream along Xidatan strike-slip fault in south of 60th station of the Golmud-Lhasa Highway



图 35 西大滩地震破裂左旋错断冲沟 9m

（镜头向北西）

Fig.35 View northwestward at 9m sinistral offset of stream along Xidatan strike-slip fault in south of Xidatan valley



图 36 东大滩 T_2 阶地地震破裂与鼓包探槽剖面

探槽揭示晚晚更新世晚期暗灰色砂砾石层背斜轴部切割全新世暗棕色砂土的次级破裂，镜头向东。

Fig.36 View eastward at trench perpendicular to pressure ridge and seismic fracture in T_2 terrace of Dongdatan valley



图 37 东大滩 T_2 阶地地震破裂探槽 Tc_9 剖面

探槽揭示全新世地震破裂，白色圆圈表示测年样品取样位置，镜头向西。G1-晚更新世晚期暗灰色砂砾石层；S0-全新世暗棕色含砾砂土，BDT4-1-样品编号，6.2ka-样品光释光年龄，说明较晚一期古地震发生时代≤6.2ka。

Fig.37 View westward at trench Tc_9 indicating seismic fracture separating Holocene dark brown sandy soil (S0) and Late Pleistocene gray pebbles in T_2 terrace of Dongdatan valley with BDT4-1/6.2ka as sampling location/OSL age.

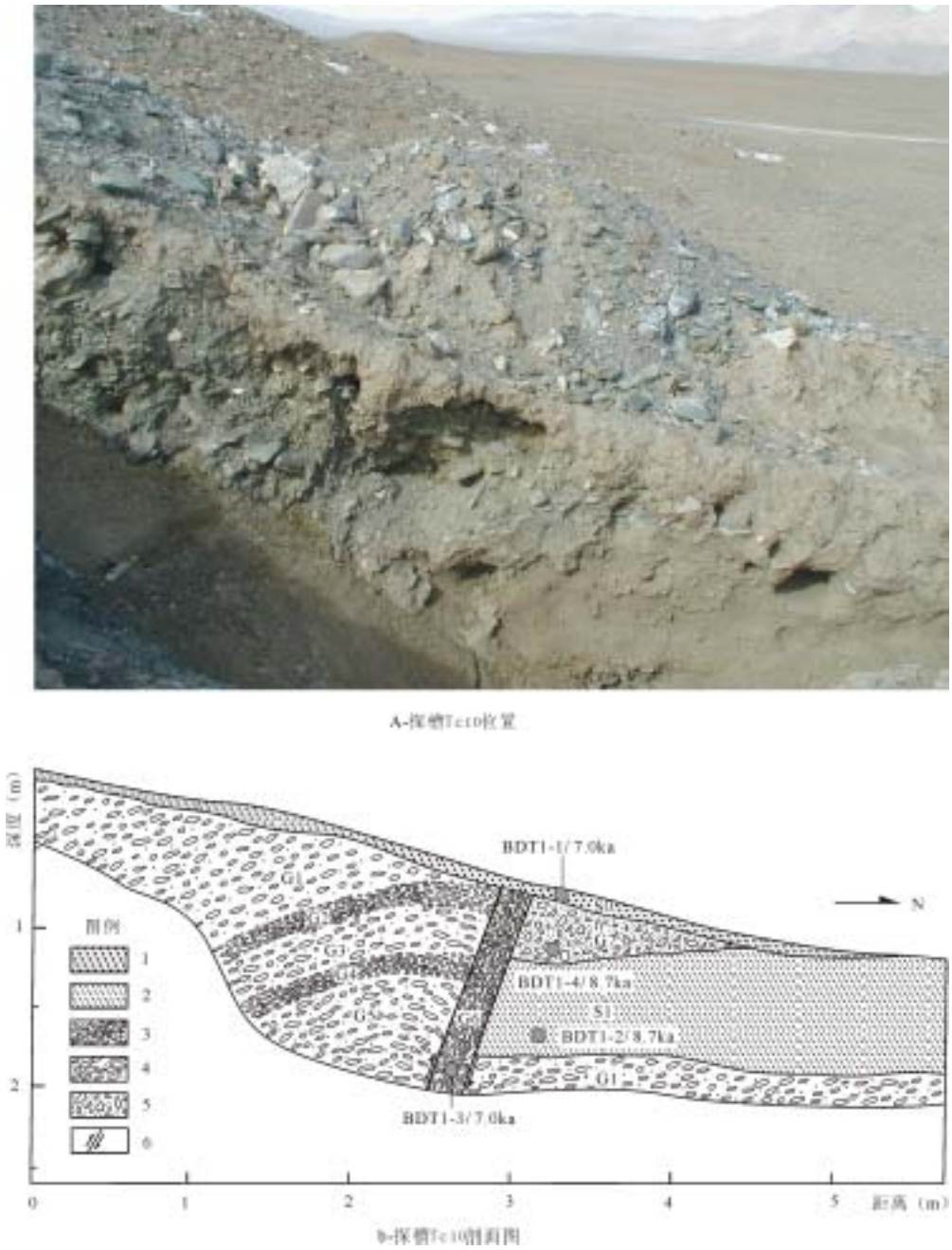


图 38 东大滩 T_6 阶地地震鼓包与地震破裂探槽剖面

照片 a 显示探槽剖面 Tc_{10} 横切地震鼓包北侧断层陡坎，镜头向西；图 b 为探槽 Tc_{10} 剖面素描图。G5-G1 表示晚更新世晚期暗灰色砂砾石层，S0-全新世暗棕色含砾砂土层，S1-暗棕色重力堆积含砾粉砂土；G7-为地震崩积楔。BDT1-1~BDT1-4 为测年样品编号，7.0ka 与 8.7ka 表示光释光年龄，揭示较早一期古地震发生时代为 7.0ka。图例说明：1-土壤层；2-黄褐色粉砂质粘土；3-细砾石层；4-粗砾石层；5-地震楔；6-地震断层。

Fig.38 Trench cross-section of Tc_{10} perpendicular to major seismic fracture in north of pressure ridges in T_6 terrace of Dongdatan valley. Explanation: a-view westward at trench Tc_{10}; b-cross-section of trench Tc_{10}. G5-G1 represents Late Pleistocene dark gray pebble; S0 represents Holocene dark brown sandy soil; S1 represents re-transported sandy soil; G7 represents seismic wedge. BDT1-1~BDT1-4 represents sampling location for OSL dating and ages of palaeo-earthquakes. Legend: 1-dark brown soil; 2-dark brown sandy clay; 3-fine pebble; 4-coarse pebble; 5-seismic wedge; 6-major seismic fracture.



图 39 东大滩地震鼓包探槽 Tc_8 剖面

（镜头向东，探槽揭示地震鼓包内部晚更新世晚期暗灰色砂砾石层的背斜褶皱构造）

Fig.39 View eastward at trench Tc_8 showing active anticlinal folding of pressure ridge in Dongdatan valley



图 40 西大滩惊仙谷地震鼓包剖面位置

（镜头向北西，南侧为较大地震鼓包，北侧为较小地震鼓包）

Fig.40 View northwestward at trench Tc_1 across pressure ridges of north Jingxiangu stream in west Xidatan valley



图 41 西大滩惊仙谷地震破裂剖面

剖面位于惊仙谷较大地震鼓包南侧，断层暨地震破裂切割晚更新世晚期暗灰色砂砾石层和全新世棕黄色砂土层，镜头向西。

Fig.41 View westward at seismic fracture separating Late Pleistocene gray pebbles and Holocene brown sandy soil in south margin of Jingxiangu pressure ridge



图 42 西大滩惊仙谷地震鼓包及年龄剖面

（南部较大地震鼓包剖面，镜头向北西，XDT1-2/6.8ka 等表示 OSL 年龄；BD1901/6.13ka 等表示 TL 年龄）

Fig.42 View northwestward at south section of trench Tc_1 perpendicular to Jingxiangu pressure ridge in west Xidatan valley with XDT1-1/15.5ka and BD1902/8.59ka etc. representing OSL and TL ages of paleo-earthquakes respectively