Application of satellite remote sensing imagery for studying active structures in the Yanqi basin, Tian Shan, China

Bihong Fu[1], aiming lin[2], Ken-ichi Kano[3], Tadashi Maruyama[4], Jianming Guo[5]

[1] Graduate School of Science and Technology, Shizuoka Univ., [2] Institute of Geosciences,Shizuoka Univ, [3] Faculty of Sci., Shizuoka Univ., [4] Institute of Geosciences, Shizuoka Univ., [5] Lanzhou Institute of Geology, Chinese Academy of Sciences

In this study, we report the interpretative results of active structures using high resolution satellite imageries in the Yanqi Basin, which is a Mesozoic-Cenozoic intermontane basin located on the southeastern flank of the Tian Shan. Landsat TM and IRS-1C satellite imageries, especially, the stereogrsphic pairs have been created for analyzing active structures. Large-scale stereographic pairs of IRS-1C imageries have been used for interpreting active structures and field mapping. These characteristics of folds and faults indicates that the folding and faulting mainly occurred in the early Pleistocene has been stopped since the late-mid Pleistocene in the northern edge but are still ongoing in the southern edge of the basin.

The Chinese Tian Shan extends broadly east-west for over 1,700 km with width of 250-300 km. It is considered an intracontinental orogenic belt formed in the late Paleozoic, which has been reactivated since the India-Eurasia collision in the Cenozoic. The study of active structures within and around the Tian Shan is not only involved with understanding active deformation caused by the India-Eurasia collision and seismic hazard assessment, but also in analyzing the migration, accumulation and preservation of petroleum resources in adjacent sedimentary basins, such as Tarim, Junggar, Turpan-Hami and Yanqi Basins.

In this study, we report the interpretative results of active folding and faulting structures by using high resolution satellite imageries in the Yanqi Basin, which is a Mesozoic-Cenozoic intermontane basin located on the southeastern flank of the Tian Shan. Landsat TM (30 m ground resolution) and India Remote Sensing (IRS-1C, 5m ground resolution) satellite remote sensing data have been processed by using ER-Mapper software, especially, the stereo pairs have been created for analyzing active structures. Large-scale (1:100,000 to 1:10,000) stereo pairs of IRS-1C imageries have been used for interpreting active structures and field mapping. Detailed analyses of satellite imagery indicate that the active fold structures are well-developed in the Quaternary alluvial fans in the both northern and southern edges of the basin, which are parallel or slightly oblique to the east-west extending Tian Shan ranges. All the Quaternary strata and alluvial fans are deformed by folding as wave forms and displaced by active faults in the southern edge. In the northern edge of the basin, however, the early Pleistocene strata are strongly folded, the late-middle Pleistocene strata and alluvial fans are little deformed by folding and faulting. The active faults are mainly distributed in the southern edge of the basin extending for >300 km, which show typical tectonic characteristics of strike-slip faults. Fault scarps are well-developed in late Pleistocene alluvial fans, which immediately adjacent to the fault trace alternate along strike from northeast-facing to southwest-facing and form a left-stepping en echelon pattern. The drainage system across the fault scarps incising the late Pleistocene alluvial fans and flowing northeastward is systematically offset or deflected dextrally up to 250 m along the faults. The tectonic deformed characteristics of folds and faults indicates that the folding and faulting mainly occurred in the mid- Pleistocene and has been stopped since the late Pleistocene in the northern edge but are still ongoing in the southern edge of the basin. This shows that the Cenozoic deformation caused by the India-Eurasia collision within the Tian Shan has mainly concentrated on the boundary between the Tian Shan and Tarim since the late Pleistocene. The interpretation and analyses of the satellite remote sensing imageries are well consistent with the ground truth checked by field work as reported by Lin et al. (2001). Satellite remote sensing techniques provides us a very powerful tool for active tectonic study in the arid to semi-arid regions like the northwestern China.