Paper Number: 1104

Integrated remote sensing and geological data utilization for geological interpretations of the Gonghe Basin, NW China

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The Central Orogenic System situated in the central China continent is the main amalgamation of China continent. It was formed through different conjunction and transformation of different orogens that constitute the China continent (Guo et al., 2007). Qinling and Kunlun orogenic belt are the important part of Central Orogenic System. Much of present research and published studies focused on the Qinling Orogenic belt (QOB), Eastern Kunlun Orogenic Belt (EKOB) and Western Kunlun Orogenic Belt (WKOB), no comprehensive study of available multiple remote sensing data that would enable a regional analysis of the structure and rock types of Gonghe Basin (Fig. 1), the conjunction area of QOB and EKOB, has been conducted so far. Remotely sensed images study on Gonghe Basin are insufficient. Therefore, in this research, an design was made to integrate a variety of data sets including Shuttle Radar Topography Mission (SRTM) data, Landsat ETM+ data, geological maps with different scale as well as field geological investigation data. This type of study provides important clues about the present and development of the Gonghe Basin and the adjacent area which is essential for further structural research. Geological faults and lineaments in Gonghe Basin are easy recognizable on DEMs; shaded relief maps were constructed from the STRM DEM data was also utilized to extract drainage patterns to assist in the identification of geological lineaments in the study area. The integration of all results was used to give new insight into the structure and tectonic history of the study area. This has reduced the ambiguity of geological interpretations.

Remote sensing and field observations were applied to map fault patterns in the study area. A variety of satellite images were used to accomplish structural analysis, Landsat ETM+ images with a spatial resolution of 28.5m. The materials used in this research including 1:200,000 and 1:500,000 scale geological maps of the Gonghe Basin, topographic maps at 1:200,000 scale, Landsat ETM+ data in bands 1-7. Landsat ETM+ data of the Gonghe Basin have been acquired and processed in several ways to enhance the geological units and structure of the area.

Certain band ratios are particularly suited to distinguish specific geologic features, such as the ETM+ band ratio combination 5/7, 5/1, 5/4*3/4. Satellite images with diverse spatial resolution are useful for identifying fault traces and structural patterns at different scales.

Statistical analysis of lineament length, density and trends based on the age of the geological formations provides useful information about the tectonic evolution of the area of interest. Ground survey data collected were used for verification of the remote sensing data.

This approach is particularly useful in Gonghe Basin, northwestern China, where routine fieldwork may be difficult and where very few details are available on structures developed.

Different RGB color combinations were examined and the 5-3-1, 7-5-3, and 4-7-2 Landsat ETM+ images proved to be the best for visual interpretation. Color composite images are most useful for distinguishing rock types in the study area.

The observations in this paper show the effectiveness of the landscape using remote sensing data can provide information on the tectonics of Gonghe Basin and the distribution of faults and rock units. The faulting identified in this paper is hence important for descriptions of the tectonics of Gonghe Basin,

northwestern China. The identification and mapping of active faults is a useful guide for future detailed studies. Remote sensing studies can provide preliminary identification and analysis of geological mapping in this area.

Thus, these observations can be extended to broad regions and mapped when specific rock types and structures on the ground are determined from comparison with published maps and are linked with their remotely sensed spectral signatures.

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