A rapid crater detection method for statistics of crater on planetary surface

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Impact craters are key geomorphological structures formed by the collision of a meteoroid, asteroid or comet with a planetary surface. They can accumulate over a long period of subsequent bombardment or slow surface erosion, which provide us with the relative age of the surface unit and more information on the planetary surface geology and its evolution. As statistics of crater form the basis for geologic stratigraphy, planetary surface chronology and so on, automatic crater measurement, detection and derived crater size frequency distribution become a routine activity in planetary science.

There are many publications devoted to various techniques of crater detection, but the efficiency is quite a problem when much of these methods come to high resolution planetary image due to the extremely high computational complexity. In our study, we employ a method derived from face detection technique, which significantly improve the efficiency while remaining a robust performance in two ways: 1) using several Haar-like features to model some basic crater characteristics, such as crater rim, illumination mode, which can be computed very rapidly on a so-called integral image; 2)cascade of classifiers trained by a AdaBoost algorithm [1], where simpler classifiers in previous stages are used to reject the majority of negative targets before more complex classifiers are called upon to make further more complex computation on a promising positive target.

[1] Viola & Jones (2004), International Journal of Computer Vision 57(2), 137–154.

Geochemistry and tectonic significace of Neopaleozoic Granitoid in Alxa Area, Inner Mongolia, China

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Alxa area located in the southern edge of Central Asia Orogenic Belt and the western margin of the North China plate. The study area has numerous granite, particularly in the Neopaleozoic (Carboniferous-Permian) granites are most widely distributed, which Contain much abundant information of tectonic evolution. Carboniferous-Permian is the key period to the formation and evolution of Central Asian Orogenic Belt, Moreover, Carboniferous-Permian are the most important periods for large-scale mineralization.At the present, the research of granites in geological age, petrogenesis and tectonic setting are very absent. Based on analyzing of geochronology, petrology and geochemical of granitoid in the study area, the Carboniferous-Permian petrogenesis and tectonic setting have been discussed. The results indicate that these granitoid are dominated by monzonitic granite, granodiorite, tonalite, quartz diorite and diorite, which emplaced in Carboniferous, later Early Permian and Late Permian. The samples of Carboniferous are metaluminous, calc-alkalic, I-type granitites, but the samples of Permian are metaluminous to peraluminous, calc-alkalic to alkalic, I-A type granites. These granitoid show not only the characteristics of within plate setting, but also that of subduction zone. And their arc-like geochemical features (such as Nb-Ta depletion) should have been inherited from the protoliths(pre-existing island arc igneous rocks), rather than inflection of their tectonic setting when they formed and contaminationed by old crust materials during magma ascending and emplacement. It is concluded by comprehensive analysis that Carboniferous-Permian granitoid of the study area are formed in post-collision tectonic setting, and are the product of the tectonic transition from compression to intraplate extension.

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