A Self-Adaptive Intelligent Inspection System for Polar Palaeoenvironment Research

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Despite the fact that polar regions are classified as a pivotal position in geology and palaeoenvironment research due to the unique natural conditions and location, the extreme environment and current problems with sampling technology carry out unpredictable risks for polar expeditions. In this paper, a polar exploration robot with an adaptive system is proposed as a sampling tool for geological analysis of Antarctic samples. Aiming to solve the problems of the traditional detection robot, such as small diameter range, unadjustable traction force, poor obstacle crossing ability and large cornering radius, this paper proposes a mechanical structure with "3+3 layout form" and "12 adaptive wheels". On the basis of the developed PID control algorithm, an active self-adaptive robot design with improved passability, flexibility and adaptability is achieved. Having higher stability than similar products, the maximum operating speed of the system is up to 8×10^-2m/s, the minimum turning radius is 0.65m, the maximum climbing slope is 90°, and stable at low temperature for 24 hours. In this paper, the authors investigated the petrology and zircon U-Pb geochronology of the intrusive rocks collected from Palmer Archipelago, Antarctic Peninsula. In X-ray fluorescence analyses, the intrusive rocks are classified as calc-alkaline andesite. LA-ICP-MS analyses yielded zircon U-Pb ages of 51Ma±4Ma for the calc-alkaline andesite. The geochemical features reveal important tectonic significance. The intelligent system can be used in different polar scenes for detection or sampling, providing a new means for polar scientific research.

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