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火山"熔岩流气泡古高度计"及其在云南腾冲火山区的应用

作者	单位
郭正府	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029
张茂亮	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029
成智慧	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029
刘嘉麒	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029
张丽红	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029
李晓惠	中国科学院地质与地球物理研究所,新生代地质与环境重点实验室,北京 100029

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摘要：

通过对火山熔岩流及其气泡特征的研究能够确定熔岩流喷发时的古高度,本文将这一方法称为火山"熔岩流气泡古高度计"。"熔岩流气泡古高度计"是在实地测量熔岩流厚度和实验室对熔岩流顶底气泡体积精确测定的基础上,利用流体力学原理和气体状态方程,通过计算古大气压强,最终获得火山喷发时的古高度。由于火山岩是开展同位素测年的理想材料,并且利用熔岩流计算古高度所需的参数(熔岩流厚度和气泡体积)不受古气候等因素(温度、降雨量等)影响,因此,这一方法以其可靠的年龄和独立的计算参数明显区别于其它古高度计。"熔岩流气泡古高度计"核心技术包括:(1)熔岩流的挑选与厚度测量;(2)熔岩流底部和顶部气泡体积的计算。中等规模、具简单冷凝历史,并且厚度稳定的偏基性熔岩流,是开展古高度计算的理想对象。熔岩流气泡体积的测试手段包括注胶、岩石抛光-扫描、体视学转换和三维CT扫描4种方法。"熔岩流气泡古高度计"最终计算结果误差为400m左右。本文利用"熔岩流气泡古高度计"计算了腾冲火山区熔岩流的古高度,研究结果显示:"熔岩流气泡古高度计"计算的黑空山熔岩流高程与目前的实际高程相吻合。开展"熔岩流气泡古高度计"研究的前提是研究区必须出露保存完好的熔岩流。我国青藏高原的隆升历史一直是国际学术界争论的热点课题,那里出露大面积熔岩流。可以预见,"熔岩流气泡古高度计"将会逐渐成为研究青藏高原隆升历史的有效手段之一。

英文摘要：

Based on measurements of thickness of lava flow and sizes of the vesicles at the top and the bottom of the lava flow, the palaeoelevation of Heikongshan lava flow emplacement in Tengchong volcanic eruptive field (SW China) at the Holocene times may be calculated by a relation of the palaeoatmospheric pressure with vesicle sizes in the lava flow. The lava flow, which could be used as paleoelevation calculations in Tengchong, had to merely undergo a simple and clearly recognized history from eruption, cooling to emplacement without inflation and deflation based on the observations and analyses in the field works during 2009~2010AD. In theory, the best fit thickness for the lava flow to the calculations of palaeopressure and then palaeoelevation is about 3m, which could produce one bar of palaeoatmospheric pressure at its top and two bars of total pressure at its bottom. In fact, the basaltic flows with 1~5m in thickness have been used as candidates for the calculations of palaeoelevation in the Heikongshan lava flows of Tengchong volcanic eruptive field (SW China). Unlike the measurements of the thickness of lava flow in the field work, sizes of the vesicles at the top and the bottom of the lava flow could be merely determined in the laboratory, the most accurate technique of which is 3D X-ray Tomography in situ. We have carried out the analysis of the sizes of the vesicles at the top and the bottom of the Heikongshan lava flows by microscope observations, based on a conversion from 2D to 3D by calculations. The final calculation results have indicated that palaeoelevation of the Heikongshan lava flow is about 1713~2613m. On the basis of comparison between actual and calculation elevations, our calculated results could be accepted. Outcrops of the post-collisional most primitive lava flows are widely distributed across the Tibetan Plateau including its interior and margins; there are more than 50 sites of the Cenozoic volcanic eruptive fields in the plateau. Most importantly, two active volcanoes erupted basaltic lava flows in 1951AD and 1609AD, which is located in the NW and SE of the plateau, respectively. It will be expected to shed light on the uplift history of the Tibetan Plateau by combining of the technique with geodynamic setting analysis.

关键词：古高程 体积众数 青藏高原隆升 腾冲火山区

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黔ICP备07002071号-2
主办单位：中国矿物岩石地球化学学会
单位地址：北京9825信箱/北京朝阳区北土城西路19号
本系统由北京勤云科技发展有限公司设计