

报告题目： 中国古代工匠在火山岩中原位、定向劈裂大面积薄石板的方法

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摘要： 本文研究的手工定向劈裂大面积薄石板的方法与常见的劈裂方法（如巴西劈裂、三点弯曲破裂）有明显的不同。该劈裂方法的主要特点为：一次性劈裂石板的面积可达 150 m²（平均 45 m²），为手工可控的劈裂，劈裂的石材为 6-8 cm 厚的石板。首先，本文对主要的劈裂工具和步骤进行了描述，并从断裂力学的角度分析了劈裂石板时定向、可控（即 I 型裂纹）的原因，因为一般岩石劈裂都是 I 型和 II 型复合裂纹。其次，石板的破裂面与施加荷载的方向（即最大主压应力方向）存在夹角（约 25°），这也与常识不符。通过理论分析，发现岩石的断裂行为是由荷载和岩石几何边界之间的关系控制的。最后，本文从能量的角度分析了石板在受到多次敲击之后，在某一次敲击时劈裂面会突然产生并迅速扩展的原因。手工敲击的动能转化为石板的弹性应力-应变能，并在极轻微弯曲的石板中逐步积累，直至石板无法承受，其存储的大部分应力-应变能便以劈裂能的形式释放，形成劈裂面。这项研究为理解构造地震的发生提供了新的见解。

Manually Directional Splitting of In-situ Intact Igneous Rocks into Thin Sheets of Large-area

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Abstract: This talk presents a directional and large-area rock fracturing method. The method has distinctive features comparing with other common fracturing methods. Area of the fracturing surface can be up to 10 m² to 500 m². The rock is fractured into sheet (or plate), with thickness of 6 to 8 cm. The main fracturing tools and steps are demonstrated and described in the talk. The talk analyzes the reason of the controllable and directional mode-I rupturing in the rock from the view of fracture mechanics, since the rock crack generally propagates in the mixed crack modes I and II. Furthermore, the fracturing surface of the rock sheet has an angle (approximately 25°) to the load direction (i.e. the orientation of the maximum principal compressive stress). It is not consistent with the common sense. The rupture behavior is controlled by the relationship between the load and the geometric boundary of the rock. We analyze that the fracturing surface can suddenly and rapidly propagate after a certain striking by calculating the energies of the rock sheet. The striking energy can transfer into the elastic stress-strain energy which was accumulated in the very-slightly bended rock sheet step by step, until the rock sheet cannot bear. Then most of the stored elastic stress-strain energy releases in the form of splitting energy and propagate the fracturing. The new insights into the fracture mechanics of rock is also valuable for better understanding of trigger of tectonic earthquakes.