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海南岛早白垩世红层磁组构和古地磁新结果

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New AMS and paleomagnetic results of Early Cretaceous red beds from Hainan Island

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摘要 海南岛白垩纪红层是迄今产出古地磁结果最多的地层,但古地磁结果难以在海南岛周边古地磁结果和地质限制条件下作出合理解释.为了更好地认识海南岛白垩纪红层古地磁方向的可靠性,我们对采自前人工作地区的14个采点132个样品开展了古地磁和磁组构的综合研究.磁化率各向异性测试显示14个采点样品平均各向异性度为1.018,线理度为1.014,面理度为1.004.各采点磁化率椭球体最小轴显著偏离地层法线,没有反映出沉积或压实特征.野外调查发现采点区域的节理组交线(代表中间应力轴)与磁化率椭球体中间轴一致,意味着采点磁性矿物的排列方位很可能因构造应力影响发生改变.逐步热退磁显示14个采点分离出的特征剩磁解阻温度高于660℃,方向区别于现代地磁场方向;褶皱检验表明在褶皱展平度为80.4%(95%置信范围内褶皱展平度为77%±12.2%)时精度参数达最大,对应方向为D=359.9°, I=43.4°,K=70.2,α_{95}=4.8°,与前人的古地磁方向一致.通过与华南地块参考极对比,以及综合分析海南岛围区古地磁和地质限制条件,表明该古地磁方向是不协调的.我们认为前人和本文采样红层剩磁很可能在沉积时获得,但在沉积后受到区域构造应力的影响,致使磁性矿物排列改变,从而导致古地磁方向也发生变化.因此,我们认为这些样品所记录的古地磁方向不能准确反映海南岛白垩纪古纬度.

关键词: 海南岛 早白垩世 红层 磁组构 古地磁

Abstract: A number of studies have reported the paleomagnetic results of Cretaceous red beds from the Hainan Island, but these results are difficult to accommodate with existing paleomagnetic data and geological observations in the South China Block. In order to solve this discrepancy, we conducted a joint paleomagnetic and magnetic anisotropy study on 14 sites (132 samples) of the Cretaceous red beds. The results of anisotropy of magnetic susceptibility (AMS) show that the degree of anisotropy (the ratio of maximum and minimum axes of AMS ellipsoid, k_1/k_3),the degree of lineation (the ratio of maximum and intermediate axes k_1/k_2) and the degree of foliation (the ratio of intermediate and minimum axes k_2/k_3) of the samples is 1.018, 1.014 and 1.004, respectively. The directions of k_3 are not vertical to the bedding planes as it would be expected from normal depositional and compaction processes. Instead, in one site, the directions of k_2 are coincident with the intersection of joint fractures that represents the intermediate stress, suggesting that the distribution pattern of magnetic particles had likely been changed during tectonic strain. Thermal demagnetization shows the unblocking temperature of >660℃. Therefore, the main magnetic particles are hematite, as the same result from previous scholars. The characteristic remanent magnetic (ChRM) direction is distinctive from present geomagnetic direction. At 80.4% unfolding (95% confidence interval is 77%±12.2%), it achieves the maximum value of precision parameter (k), and the mean ChRM direction is D=359.9°,I=43.4°,k=70.2,α_{95}=4.8°. This direction is consistent with results from previous scholars, and thus our samples are representative. However, these results are inconsistent with paleomagnetic data and geological observations from nearby regions in the mainland of the South China Block(SCB). For example, if compare the magnetic paleopole (83.8° N,108.4° E, α_{95}=4.7°) of Hainan Island calculated by our data with the Cretaceous magnetic reference pole of SCB (80.1° N,204.1° E, α_{95}=2.5°), it shows that Hainan Island moved southward by about 6 latitude distance relative to SCB since Cretaceous. However, it's hard to happen because SCB was fixed near the present place and thus Hainan was not likely to locate at the place northern than today by 6 latitude. And geological survey has not found a huge fault that

could detach Hainan Island from SCB for such long distance. We interpret the ChRM as being carried by detrital hematite particles but changed during deformation because of tectonic strain-induced particle rearrangement. Therefore, the Cretaceous paleomagnetic direction carried by the red beds is unlikely an accurate record of the Cretaceous paleolatitude for the Hainan Island.

Keywords: Hainan Island Early Cretaceous Red bed AMS Paleomagnetism

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