Stress ratio of caldera bounding faults as a guide to aspects of regional stress regime

Daisuke Miura[1]

[1] Geology, CRIEPI

Stress ratio f = (s2-s3) / (s1-s3) of caldera bounding fault has been discussed to clarify influence of regional stress on the caldera formation. The variation of stress ratio provides two important conclusions; in the piston-cylinder subsidence, the slip-direction of ring fault is considered as subvertical one, indicating the f ~0. In the trap-door subsidence, however, the oblique-slip is appeared, indicating larger value of the f (~0.5). An apparent stress ratio (fH = 1-(s3/s2)) is useful to compare characteristics of the subsidence structure. The piston-cylinder subsidence indicates the fH = f. In the piecemeal subsidence, however, the fH > f , indicating that the piecemeal caldera needs to a deeper roof of the underlying magma chamber, rather than the piston-cylinder caldera.

An attempt of stress ratio f = (s2-s3) / (s1-s3) for determining the slip direction of caldera bounding fault have been made to clarify influence of regional stress on the caldera formation. The variation of stress ratio provides two important conclusions; particularly in the piston-cylinder subsidence (coherent floor subsidence), the slip-direction of caldera bounding fault (ring fault) is considered as uniformly subvertical one, indicating the lowest value of f . In the trap-door subsidence of coherent floor, however, the oblique-slip of caldera bounding faults is present, and it indicates larger value of the f, rather than the ordinary ring faulting. An example at dissected trap-door caldera reveals a coincident result with the conclusion, by use of a reduced stress tensor method. With some simple assumptions, this analogue provides an apparent stress ratio (fH = 1-(s3/s2)), which is performed to compare characteristics of the subsidence structure at respective calderas. In the piston-cylinder subsidence, fH is almost equal to the f . In the case of piecemeal subsidence, however, the fH is larger than the f , indicating that there is in need of larger stress s1 than the piston-cylinder subsidence. This relationship between f and fH probably suggest that the piecemeal caldera needs to a deeper roof of the underlying magma chamber, rather than the piston-cylinder caldera.