

## Figure Captions

**Fig.1** Stress states of rocks in different locations of underground hard rock mines

**Fig.2** Experimental methodology in this study: (a) Rock specimens and thin section analysis, (b) Testing equipment, (c) Axial and lateral strains extensometers, (d) Working principle of the extensometers

**Fig.3** Fatigue stress paths: (a) stress path used in this study; (b) low pre-stress path; and (c) Overload path

**Fig.4** Stress thresholds of rocks in uniaxial compression tests: (a) crack growth situation; (b) granite; (c) marble; and (d) sandstone

**Fig.5** Relationship between  $T_{fl}$  and  $\sigma_{min} / \sigma_{ucs}$

**Fig.6** Stress-strain curves of granite in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain

**Fig.7** Stress-strain curves of marble in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain

**Fig.8** Stress-strain curves of sandstone in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain

**Fig.9** Curves of volumetric strain versus axial strain for specimens in uniaxial fatigue tests:(a) granite, (b) sandstone and (c) marble.

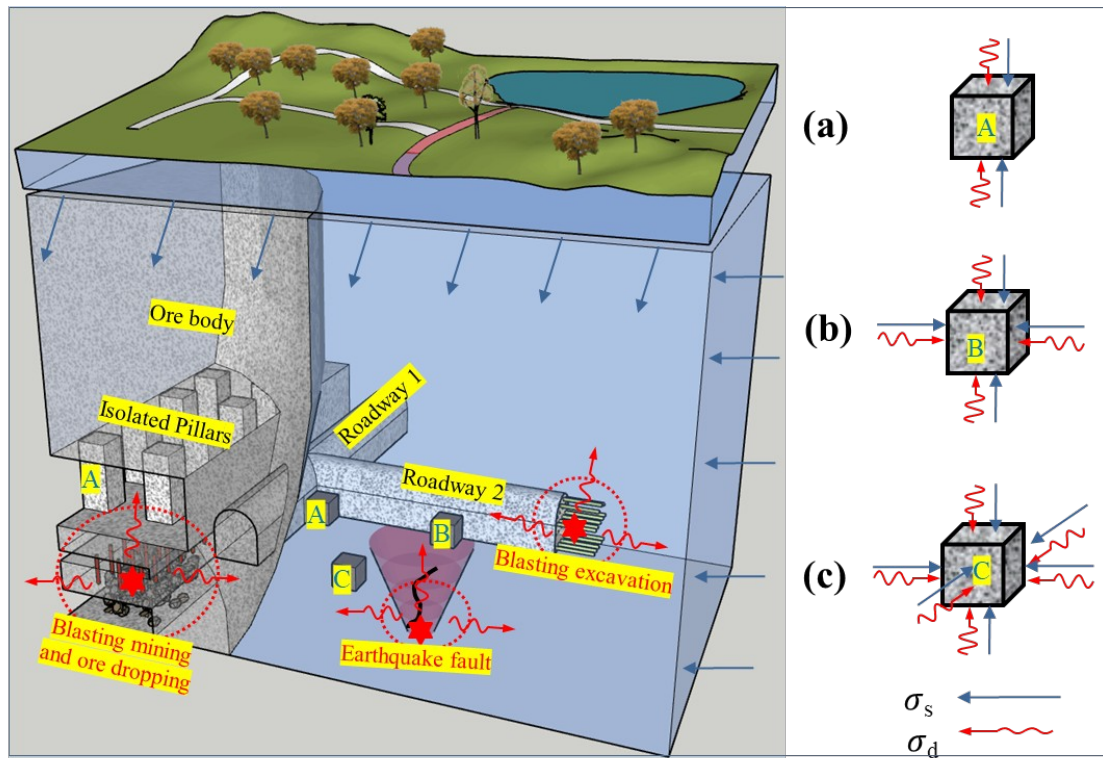
**Fig.10** Relationship between Poisson's ratio ( $\mu_c$ ) and relative time: (a) granite, (b) marble, and (c) sandstone

**Fig.11** Calculation scheme of modulus in uniaxial fatigue tests

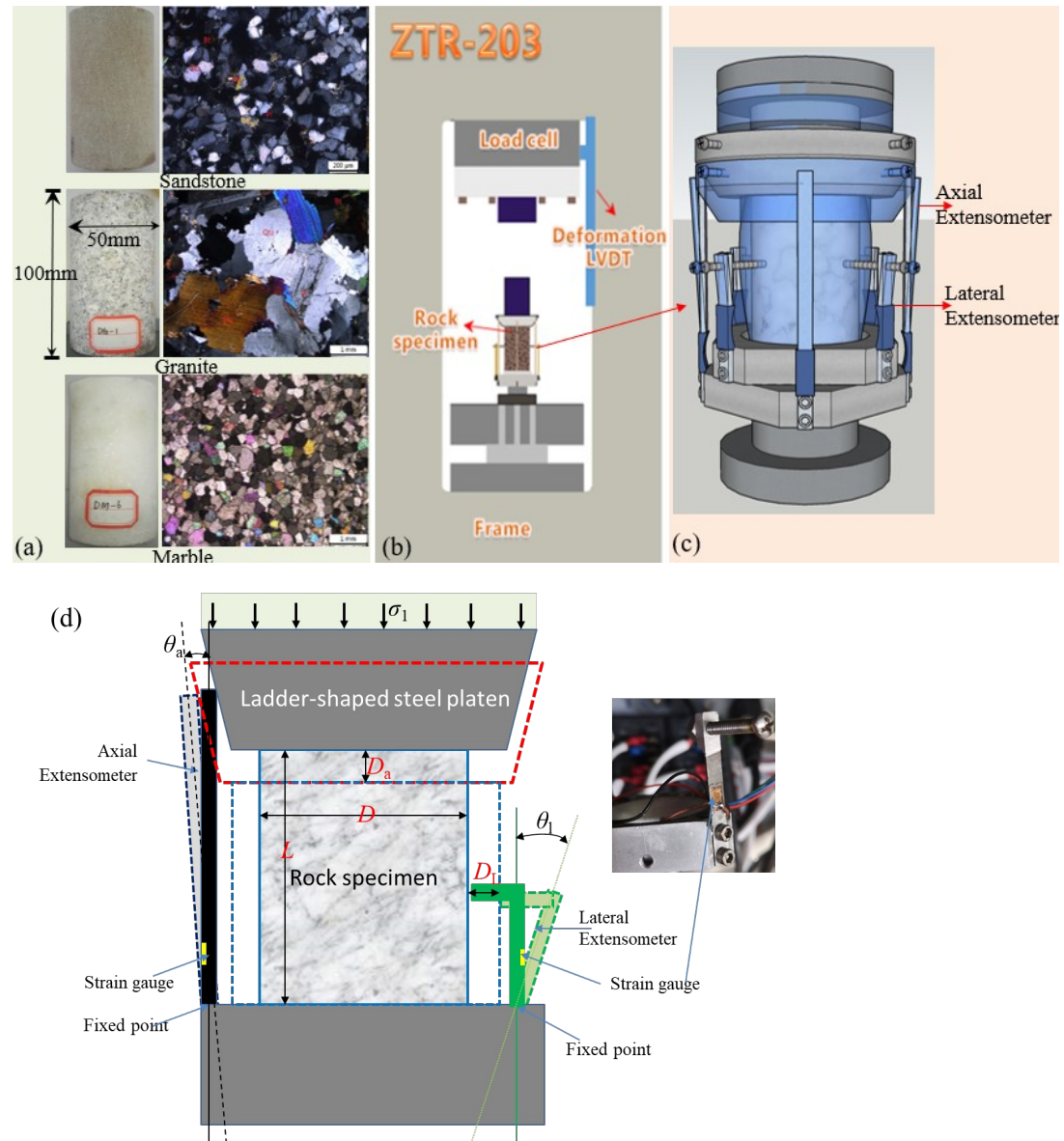
**Fig.12** Changes trend of  $E_{dtn}$  of rock specimens in the performed fatigue tests: (a-b)  $E_{dtn}$  of granite in loading and unloading parts; (c-d)  $E_{dtn}$  of marble in loading and unloading parts; (e-f)  $E_{dtn}$  of sandstone in loading and unloading parts

**Fig.13** Changes trend of  $E_{dsm}$  of rock specimens in the performed fatigue tests: (a-b)  $E_{dsm}$  of granite in loading and unloading parts; (c-d)  $E_{dsm}$  of marble in loading and unloading parts; (e-f)  $E_{dsm}$  of sandstone in loading and unloading parts

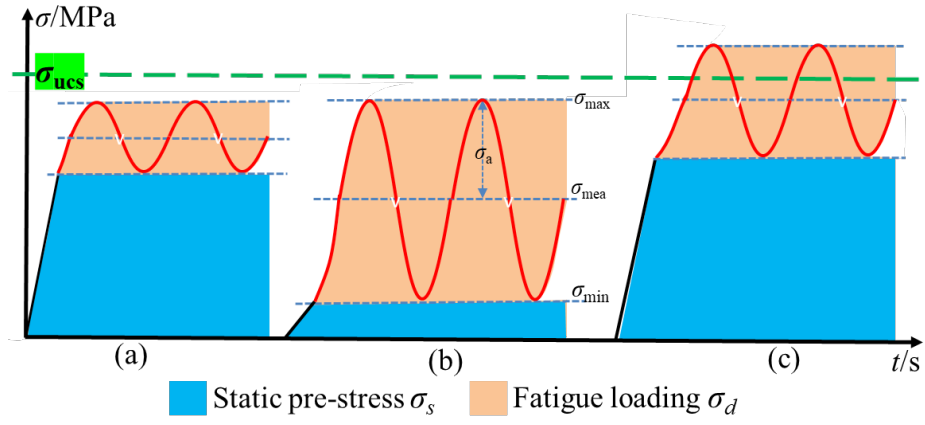
**Fig.14** Fracture fragments of specimens: (a) in uniaxial compression tests, and (b) in uniaxial fatigue tests



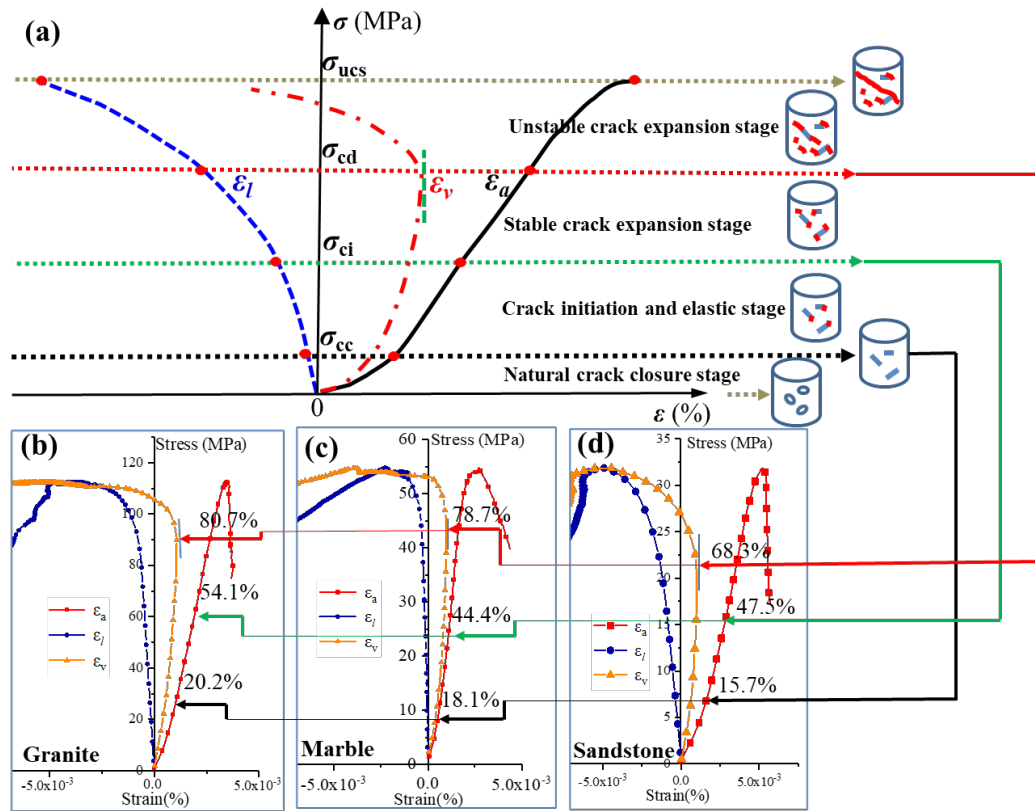
**Fig.1** Stress states of rocks in different locations of underground hard rock mines



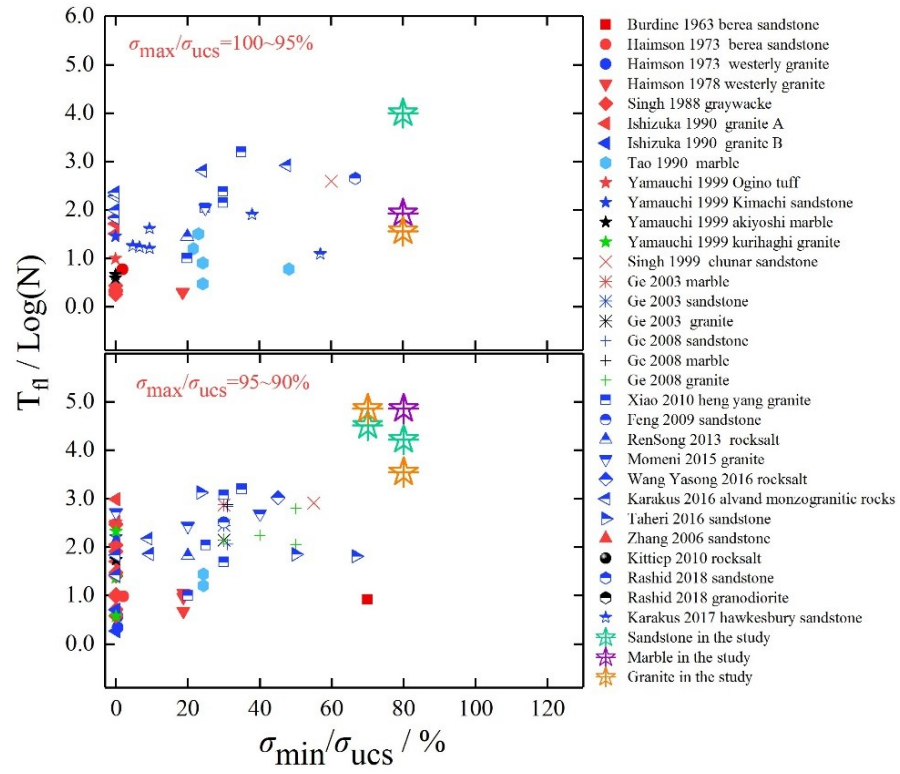
**Fig. 2** Experimental methodology in this study: (a) Rock specimens and thin section analysis, (b) Testing equipment, (c) Axial and lateral strains extensometers, (d) Working principle of the extensometers



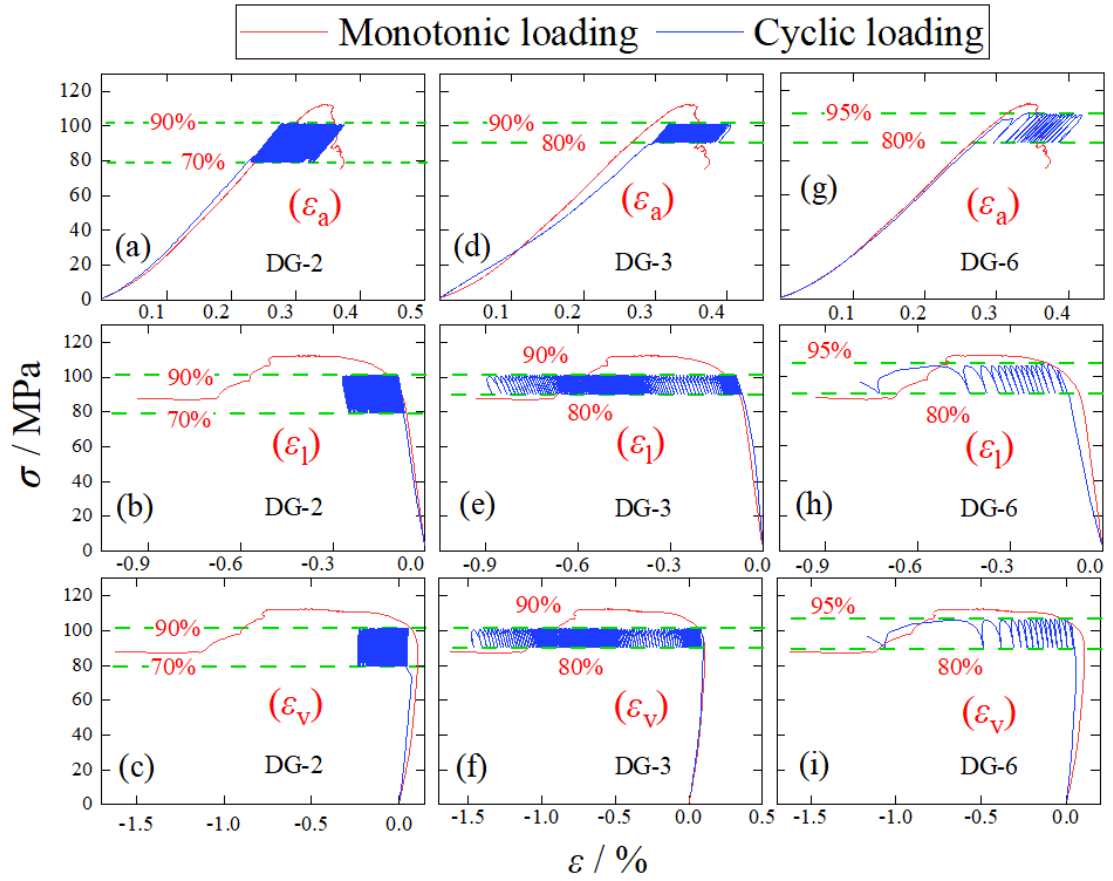
**Fig. 3** Fatigue stress paths: (a) Stress path used in this study; (b) Low pre-stress path; and (c) Overload path



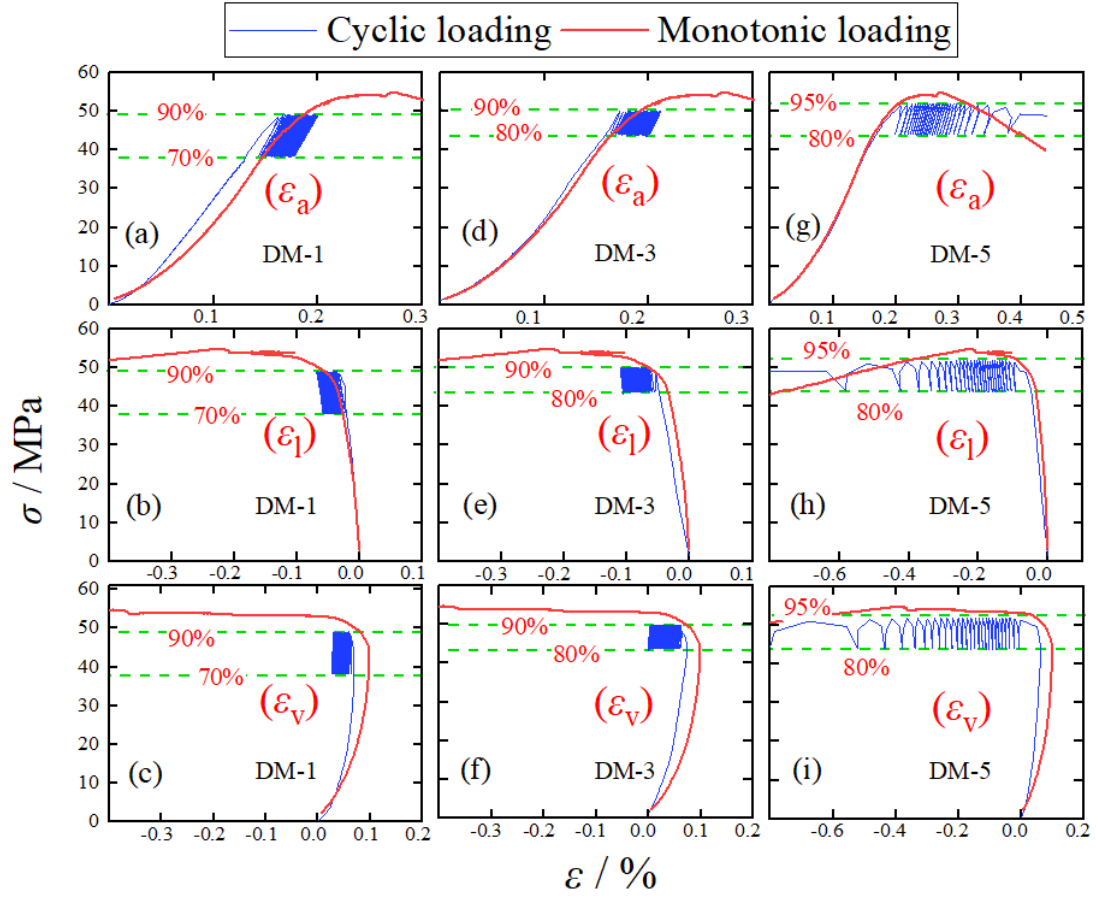
**Fig. 4** Stress thresholds of rocks in uniaxial compression tests: (a) crack growth situation; (b) granite; (c) marble; and (d) sandstone



**Fig. 5** Relationship between  $T_n$  and  $\sigma_{\min} / \sigma_{\text{ucs}}$

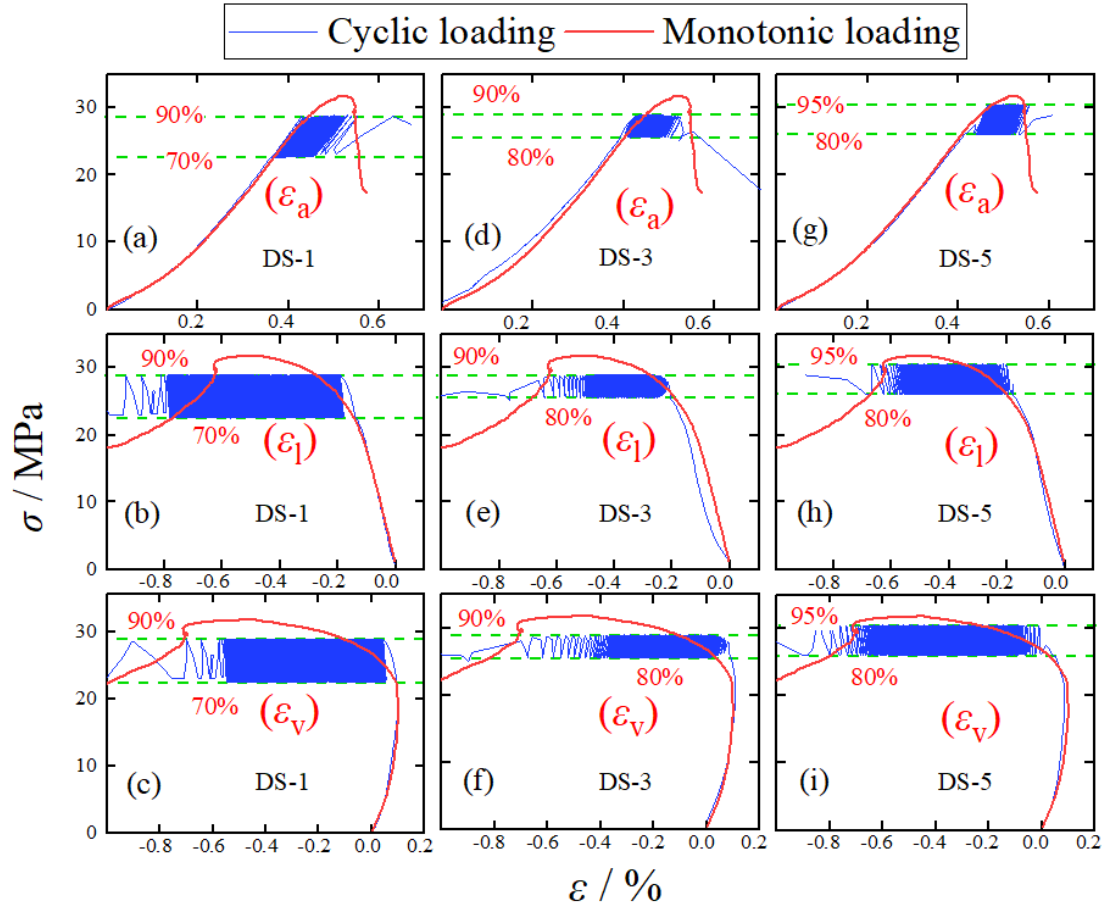


**Fig. 6** Stress-strain curves of granite in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain

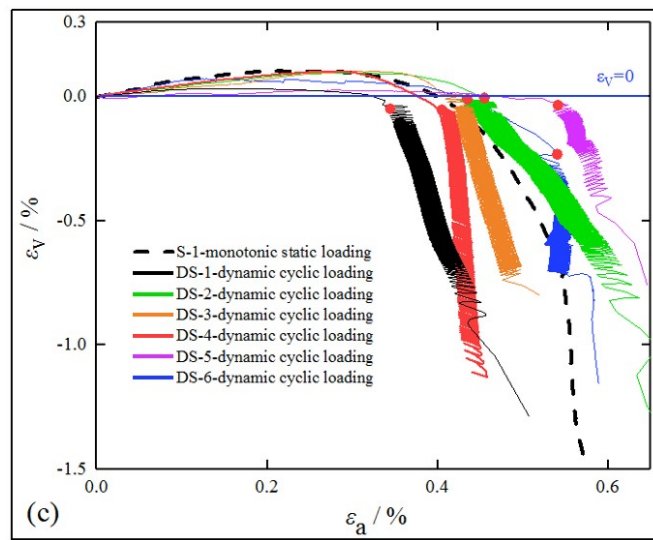
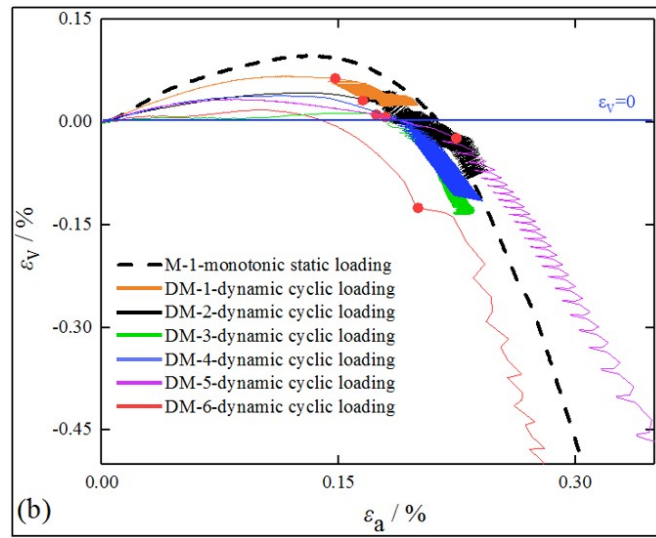
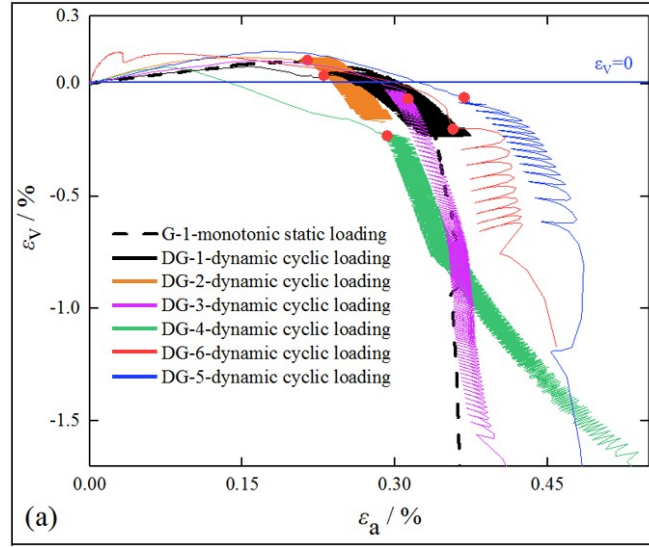


**Fig.7** Stress-strain curves of marble in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain

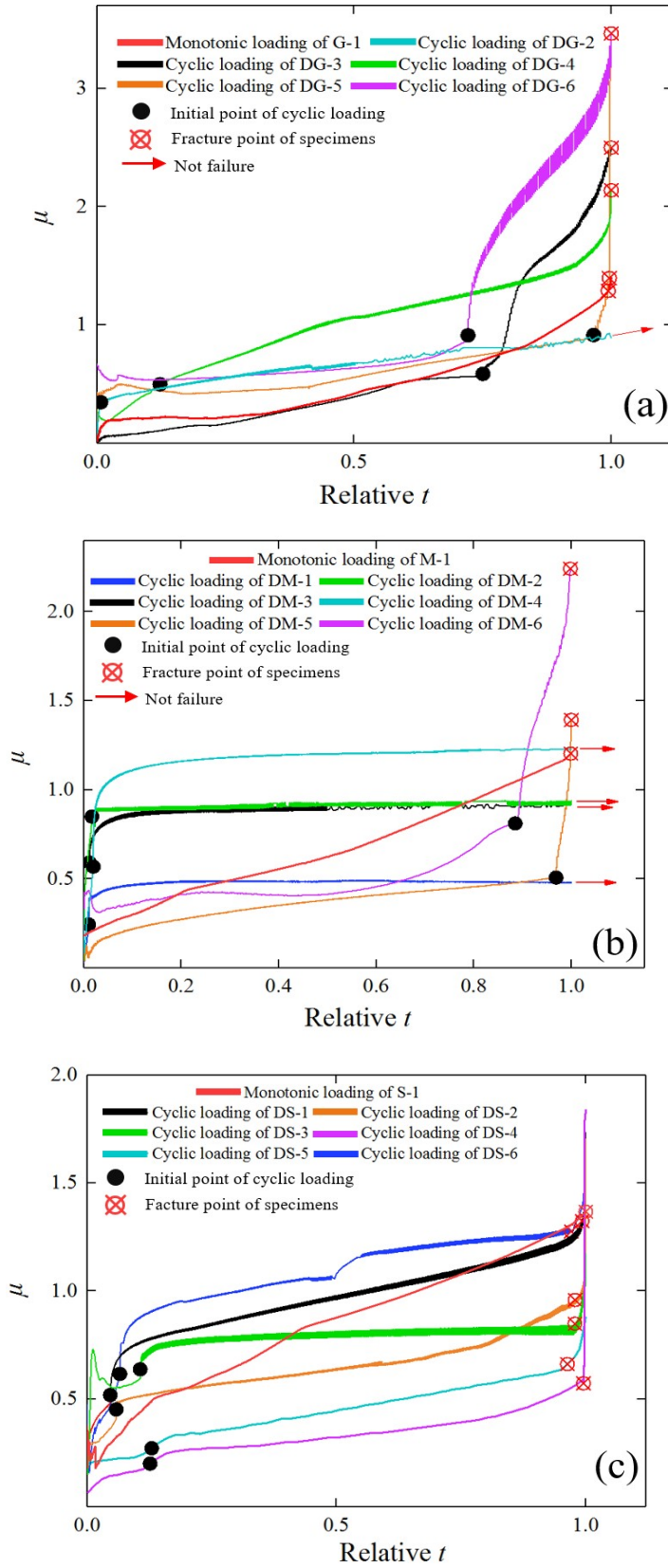




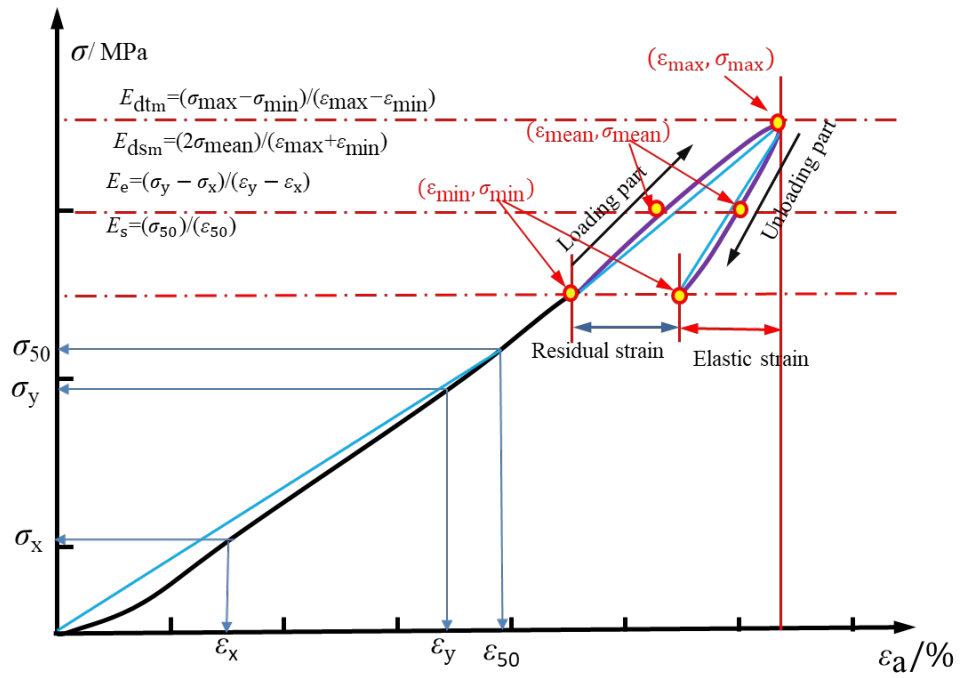
**Fig.8** Stress-strain curves of sandstone in uniaxial compression and fatigue tests: (a, d, g) axial strain, (b, e, h) lateral strain, and (c, f, i) volumetric strain



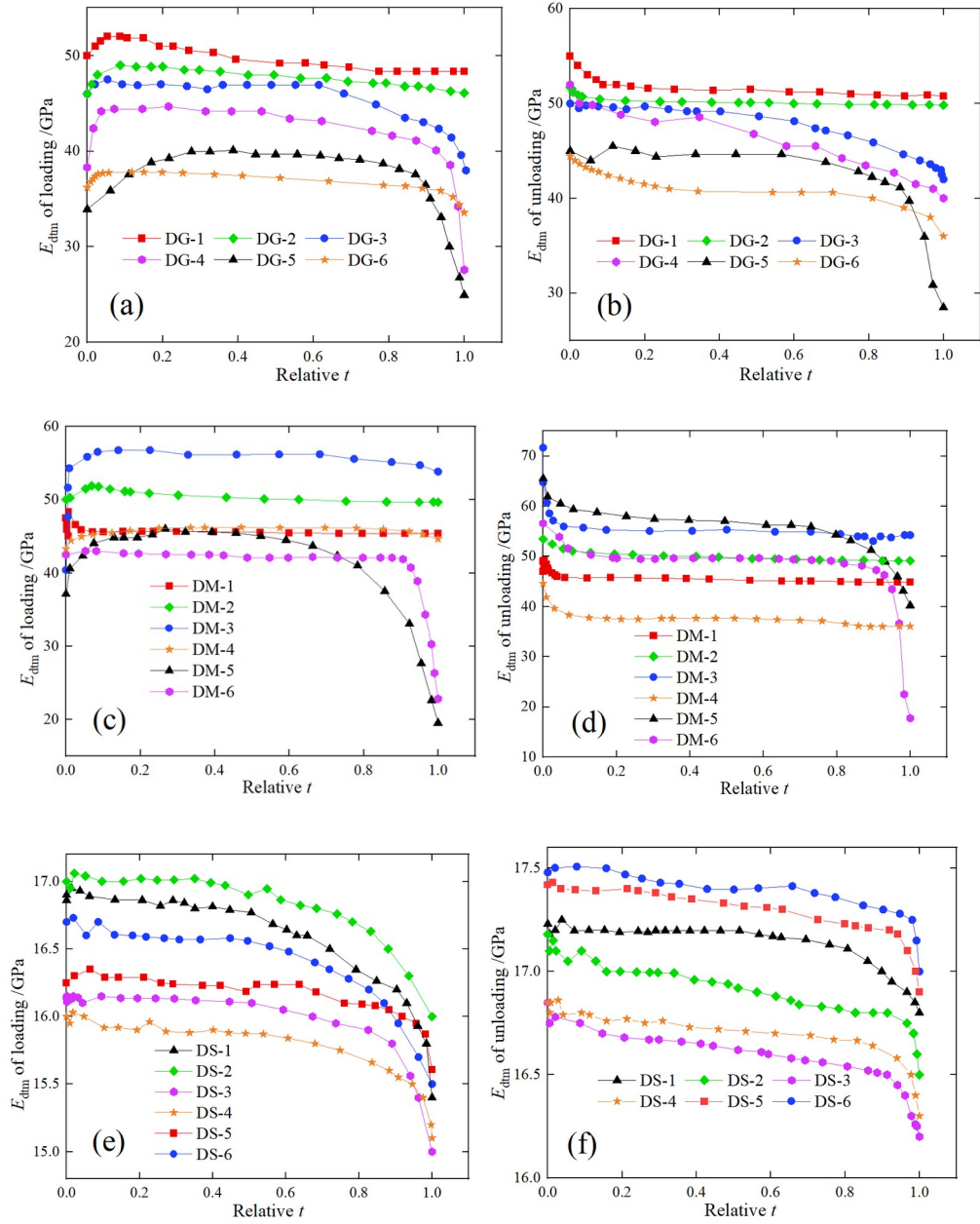
**Fig.9** Curves of volumetric strain versus axial strain for specimens in uniaxial fatigue tests:(a)  
granite, (b) sandstone, and (c) marble



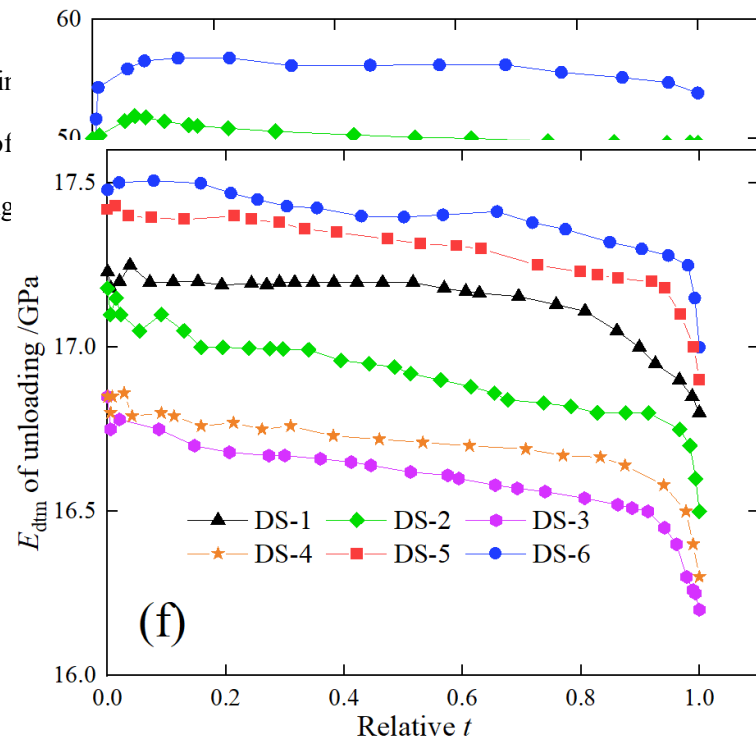
**Fig.10** Relationship between Poisson's ratio ( $\mu_c$ ) and relative time: (a) granite, (b) marble, and (c) sandstone

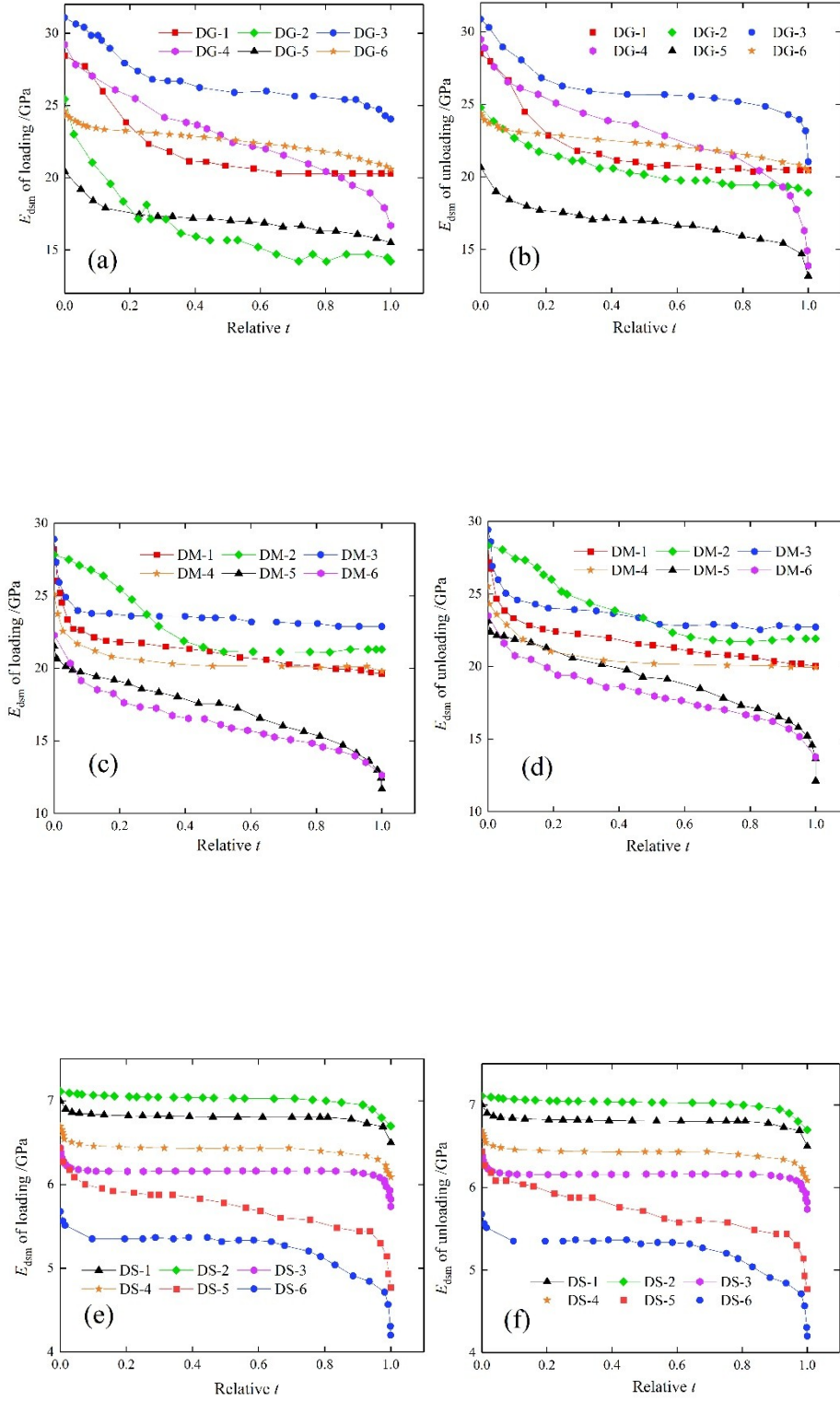


**Fig.11** Calculation scheme of modulus in uniaxial fatigue tests



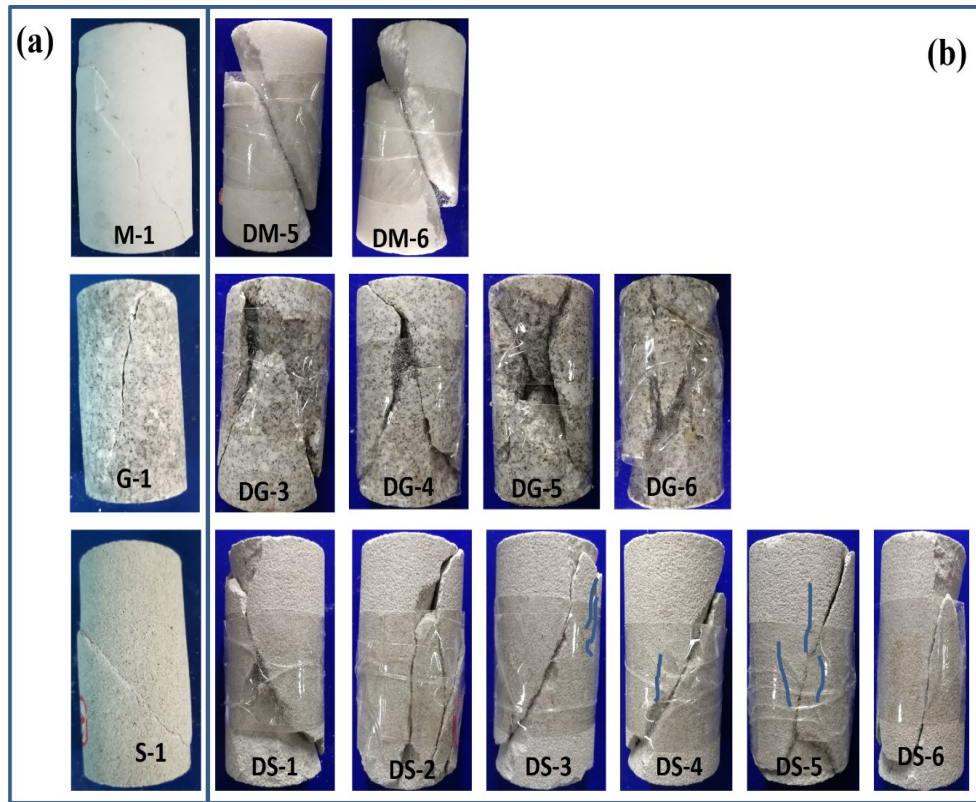
**Fig.12** Changes trend of  $E_{dtm}$  of rock specimens in granite in loading and unloading parts; (c-d)  $E_{dtm}$  of sandstone in loading





**Fig.13** Changes trend of  $E_{dsm}$  of rock specimens in the performed fatigue tests: (a-b)  $E_{dsm}$  of granite in loading and unloading parts; (c-d)  $E_{dsm}$  of marble in loading and unloading parts; (e-f)  $E_{dsm}$  of sandstone in loading and unloading parts





**Fig.14** Fracture fragments of specimens: (a) in uniaxial compression tests, and (b) in uniaxial fatigue tests