independently and only fails once. Scholz derived the theory for volumetric strains but he commented [*Scholz*, 1968, p. 3299], 'v can also be considered to be the increment of axial or lateral strain.'

If $P(F_a)$, the transitional probability of fracture at a stress F_a, does not vary with time, the probability P that an element will fracture in the next time interval dt after a time t under stress F_a is given by

$$P = P(F_a) \exp\left[-P(F_a)t\right] dt \tag{2}$$

and this leads to

$$P(F_a) = 1/t_f \tag{3}$$

Substituting equation 3 in equation 1 gives

$$P(F_a) = a \exp\left[-(E/KT) - b(F_m - F_a)\right] \tag{4}$$

If $N(F_a, t)$ is the number of elements under stress F_a at time t, then the probability of one of these elements failing in the subsequent time interval dt is

$$f(F_a) = N(F_a, t)P(F_a)\, dt \tag{5}$$

$$d[N(F_a, t)]/dt = N(F_a, t)P(F_a) \tag{6}$$

The axial creep rate is then

$$\dot{e}_t = v \int_0^{F_m} N(F_a, t)P(F_a)\, dF_a \tag{7}$$

Integration of equation 6 from zero to time t gives

$$N(F_a, t) = N(F_a, 0) \exp\left[-P(F_a)t\right] \tag{8}$$

Differentiation of equation 4 leads to

$$d(P(F_a)) = -b\, P(F_a)\, dF_a \tag{9}$$

Assuming that the initial distribution, $N(F_a, 0)$ is uniform in the interval zero to F_m, and is zero outside it, then $N(F_a, 0) = N$. Equation 7 can then be written

$$\begin{aligned}\dot{e}_t &= vN \int_0^{F_m} P(F_a) \exp\left[-P(F_a)t\right] dF_a \\ &= (vN/b) \int_0^{F_m} \exp\left[-P(F_a)t\, d(P(F_a))\right]\end{aligned} \tag{10}$$

The integration of equation 10 leads to

$$\dot{e}_t = vN/bt \tag{11}$$

Scholz's contribution, based on the assumption represented by equation 1, comprises two statements:

$$t_f = c \exp\left[b(F_m - F_a)\right] \tag{12}$$

$$t_f = d \exp(E/KT) \tag{13}$$

Equation 12 described the static fatigue of the elements at constant temperature; equation 13 described their static fatigue at constant stress. Scholz suggested that equation 12 could be verified by experiments on the static fatigue of homogeneous specimens of silicates such as glass.

Criticism of Scholz's Theory

Scholz, then, has assumed that a creep specimen is composed of a number of elements of the same dimensions and with similar physical and chemical properties (that is, they all obey the same law of statc fatigue). The stress distribution in each element is assumed to be uniform, and the elements are each stressed to different stresses in the range from zero to the instantaneous compressive-strength of an element. Under compression of the specimen, tensile stresses are assumed to be absent.

There are immediate difficulties with these assumptions. One of these is the definition of the instantaneous compressive-strength of an element. Fracture of bodies under compression is invariably attributed to tensile stresses at cracks and other stress concentrations within the body. *Scholz* [1968, p. 3298] was clear, however, that there are no tensile stresses within the specimen; it is therefore difficult to envisage the occurrence of a fracture.

Notice, also, that the stress distribution within the specimen is specialized. If the stress distribution within the elements is uniform, then their boundaries will be free of shearing stresses, for instance. Scholz has not discussed what arrangement of the elements would produce this stress distribution. However, if the elements are to have perfectly smooth margins to eliminate shearing stresses, then the specimen may not cohere.

Scholz's theory can also be criticized for the form of equation 12. Taking logarithms of equation 12,

$$\log t_f = \log c + b(F_m - F_a) \tag{14}$$