Difference between Q Kappa and Q_p:

Dahlen and Tromp 1998, page 350

$$c_p = \sqrt{\frac{K + \frac{4}{3}\mu}{\rho}} = \sqrt{\frac{\lambda + 2\mu}{\rho}}$$

$$\Rightarrow \quad K = \lambda + 2\mu - \frac{4}{3}\mu = \lambda + \frac{2}{3}\mu \quad \text{in 3D}$$

Carcione 1993 generalize this to 2D and 3D by writing: (see also Carcione et al 1988 equation (A9))

$$K = \lambda + \frac{2}{n}\mu \quad \text{with } n \text{ the spatial dimension } (n = 2 \text{ or } n = 3)$$

Q_μ is always equal to Q_S, but Q Kappa is not equal to Q_p in general. The formula to convert one to the other is given in Dahlen and Tromp (1998) eq (9.59):

$$Q_p = \frac{1}{\dfrac{1 - \frac{4}{3}\left(\frac{c_s}{c_p}\right)^2}{Q\ \text{Kappa}} + \dfrac{\frac{4}{3}\left(\frac{c_s}{c_p}\right)^2}{Q\ \text{mu}}}$$

where $c_s = c_s(f)$ and $c_p = c_p(f)$ are given at the frequency at which one wants to perform this conversion (for a really constant Q, that frequency does not matter); however for a Zener representation of a constant Q it does vary a little bit, because $\frac{c_s}{c_p}$ will slightly vary with f because they scale as $\sqrt{\frac{1}{N}\sum \frac{\tau_{\epsilon 1}}{\tau_{\sigma 1}}}$ and $\sqrt{\frac{1}{N}\sum \frac{\tau_{\epsilon 2}}{\tau_{\sigma 2}}}$.