another, slightly different model; for instance, he reckoned the depth of compensation D from the earth's surface instead from sea level.

Although this model is highly idealized, there is a modern interpretation in which the "level of compensation" might possibly be identified with the boundary between *lithosphere* (above) and *asthenosphere* (below), so that compensation takes place throughout the lithosphere. In fact the lithosphere is believed to have a thickness of about 100 km, although with a higher average density, but what counts for compensation are the density differences.

8.1.2 The Model of Airy–Heiskanen

Airy proposed this model, and Heiskanen gave it a precise formulation for geodetic purposes and applied it extensively.

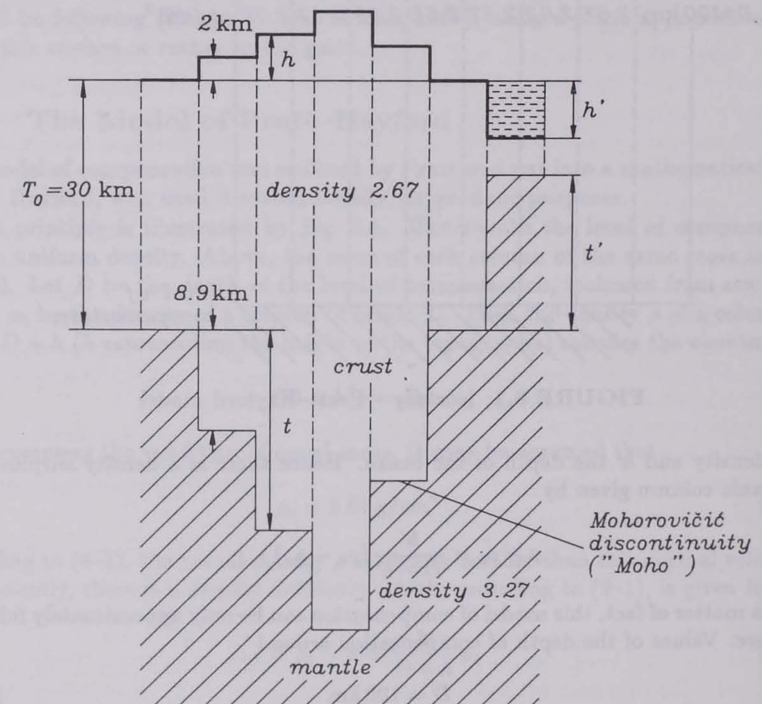

FIGURE 8.2: Isostasy – Airy–Heiskanen model

Figure 8.2 illustrates the principle. The mountains, of constant density (say)

$$\rho_0 = 2.67\,\mathrm{g/cm^3} \quad , \tag{8-8}$$

float on a denser underlayer of constant density (say)

$$\rho_1 = 3.27\,\mathrm{g/cm^3} \quad . \tag{8-9}$$

The higher they are, the deeper they sink. Thus, *root formations* exist under mountains, and "antiroots" under the oceans.

We denote the density difference $\rho_1 - \rho_0$ by $\Delta\rho$. With the assumed numerical values we have

$$\Delta\rho = \rho_1 - \rho_0 = 0.6\,\mathrm{g/cm^3} \quad . \tag{8-10}$$

If we denote the height of the topography by h and the thickness of the corresponding root by t (Fig. 8.2), then the condition of floating equilibrium is

$$t\Delta\rho = h\rho_0 \quad , \tag{8-11}$$

so that

$$t = \frac{\rho_0}{\Delta\rho}\,h = 4.45\,h \quad . \tag{8-12}$$

For the oceans the corresponding condition is

$$t'\Delta\rho = h'(\rho_0 - \rho_w) \quad , \tag{8-13}$$

where h' and ρ_w are defined as above and t' is the thickness of the antiroot (Fig. 8.2), so that we get

$$t' = \frac{\rho_0 - \rho_w}{\rho_1 - \rho_0}\,h' = 2.74\,h' \tag{8-14}$$

for the numerical values assumed.

Again spherical corrections must be applied to these formulas for higher accuracy, and the formulations in terms of equal mass and equal pressure lead to slightly different results.

The normal thickness of the earth's crust is denoted by T_0 (Fig. 8.2). Values of around

$$T_0 = 30\,\mathrm{km} \tag{8-15}$$

are assumed. The crustal thickness under mountains is then

$$T_0 + h + t \quad , \tag{8-16}$$

and under the oceans it is

$$T_0 - h' - t' \quad . \tag{8-17}$$

What we have called above "denser underlayer" is, of course, the *mantle* separated by the crust by the *Mohorovičić discontinuity*, or briefly, the *Moho*. The mantle evidently is not liquid, but over very long time spans, even apparently "solid" materials behave in a plastic way, not unlike a very viscous fluid.