Gross apparent sea-level change can be determined between any two marine horizons in any stratigraphic section, if depth of deposition at each horizon and thickness (and, ideally, compaction) of sediment between the two horizons are known. The method of determination is best explained by considering a hypothetical example:

$A$ is apparent sea-level change between two points in time, the beginning of the Hautawan epoch and the beginning of the Nukumaruan epoch. $t$ is thickness of sediment overlying the base of the Hautawan Stage when deposition of the Nukumaruan Stage commenced, and is assumed to be 1,000ft; ideally this value would be the present thickness of the Hautawan Stage, plus the amount of compaction of the Hautawan Stage that has taken place since the beginning of the Nukumaruan Epoch. $d_1$ is the depth of deposition at the beginning of Hautawan time, assumed to be 400ft. $d_2$ is the depth of deposition at the beginning of Nukumaruan time, assumed to be 100ft.

$$\text{Then } A = t + d_2 - d_1 = 1{,}000 + 100 - 400 = 700\text{ft}.$$

A positive value for A indicates an apparent sea-level rise, and a negative value indicates an apparent sea-level fall. $A$ is the sum of apparent sea-level changes within the time interval considered and gives no indication of reversals or changes in rate of apparent sea-level change which may have occurred. Gross apparent sea-level change (A) may be graphed with either the lithosphere or sea-level assumed to be fixed in vertical position.

The cyclothems of southern North Island record a series of oscillatory apparent sea-level changes superimposed on a secular apparent sea-level change—mainly rise. Figure 9 gives gross apparent sea-level change and an inferred secular apparent sea-level change for each of three Wairarapa sections, one Hawke's Bay composite section, and the Wanganui-coast composite section, the lithosphere being assumed fixed in vertical position. The Wanganui-coast graph is based on thicknesses and depths of deposition given by Fleming (1953) and depths of deposition estimated by the writer from fossil lists and lithological descriptions given by Fleming. The Hawke's Bay graph is based on thicknesses given by Lillie (1953) and depths of deposition estimated by the writer from fossil lists and lithological descriptions given by Lillie.

The oscillatory component in each gross apparent sea-level change curve has periods equal to the duration of cyclothems and of most marine stages, and periods of successive oscillations are assumed to be equal. The troughs of oscillations correspond to the boundary unconformities between cyclothems, while the peaks nearly coincide with the deepest phases of the cyclothems. Secular apparent sea-level change in each stratigraphic section is shown by the smoothest curve that lies evenly between peaks and troughs. The rate of secular apparent sea-level change is different for each section, being most rapid where deposits are thickest.

Each curve is similar to a small part of the hypothetical curve presented by Barrell (1917, Fig. 5) to illustrate base-level changes resulting from three combined rhythms of successively smaller amplitude and shorter period. Only two orders of rhythms are represented and of the higher order rhythm only a portion is represented in each of the curves.

The amplitudes of the oscillations are determined by subtracting secular apparent sea-level change from the gross apparent sea-level change. As the amount of compaction is not known it has been ignored when determining gross apparent sea-level changes.

*Inferred Eustatic Sea-level Fluctuations*

The oscillations are assumed to approximate to sine waves (Fig. 10, 1–5). The order of magnitude of determined amplitudes of successive oscillations in all