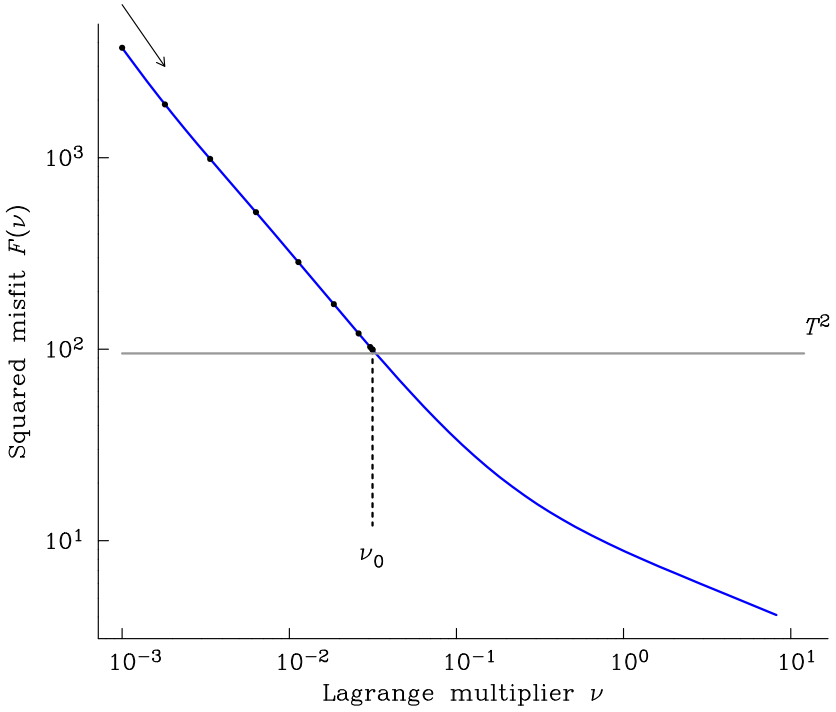

Figure 13.1: Squared misfit vs Lagrange multiplier.

guaranteed to converge. If the guess had been too high, we could not reliably use the Newton iterate, because it can ask for negative values, which are forbidden; so in those circumstances we just divide the guess by ten and try again. In this example the procedure took 10 steps to converge to about 4 significant figures. It is obvious we could get much more rapid convergence if logarithmic values (both $\ln F$ and $\ln \nu$) were used, because the curve is nearly straight in these variables, and Newton's method is based on a linear approximation. I leave the details for a homework exercise.

The norm of the new model m_0 is considerably smaller than the one obtained by an exact fit: now $\| m_0 \| = 6.26$, while a precise match yields a norm of 697. The new model is considerably more reasonable in size, as we had hoped. And this is confirmed in Figure 13.2, where the solid line is the L_2 norm minimizer. This solution is spiky but keeps its magnetization in a range of perfectly acceptable numbers. Notice the sign is predominantly positive, which we might perhaps expect as the profile is the Bruhnes normal magnetic period. The strongly reversed section between 1.6 and 2.5 km is interesting, because it is not a well recognized brief reversal. Are any of the model's reversed magnetization sections real, or can they be dispensed with while still matching the measurements? This is a question we must wait to answer.

In the same figure shown dashed is the minimizer of the 2-norm of dm/dx; it is noticeably smoother, and a little larger. The nasty spike in

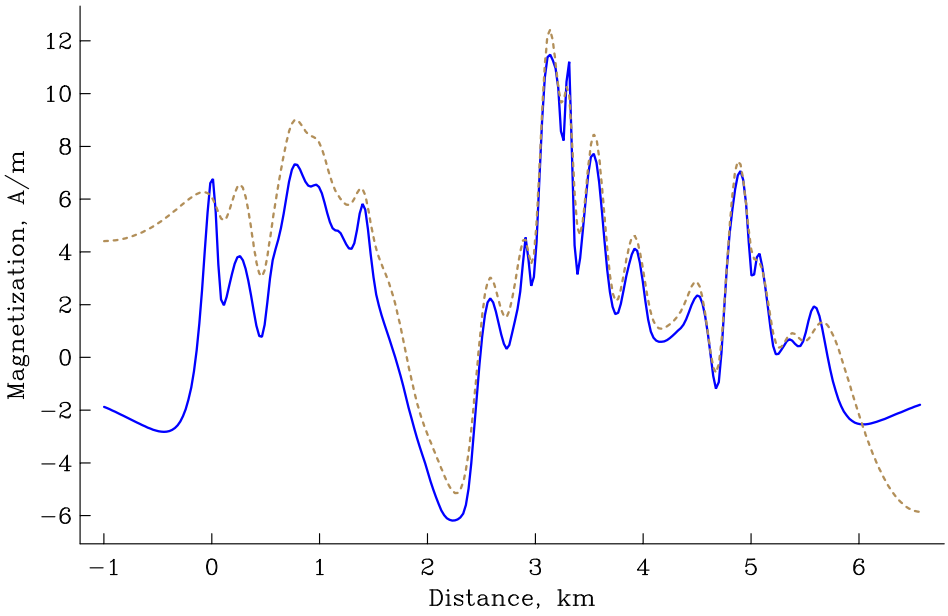

Figure 13.2: Minimum norm and seminorm magnetizations with plausible misfits.

m_0 near 3.2 km has been greatly reduced, but that is hard to see in this graph. We probably can conclude that the crustal magnetization is far from constant along this profile, and that big swings in the original field are not due to effects of topography (changes in range of the magnetometer from the sources), but are a genuine reflection of variable magnetic intensity in the basement. But whether or not reversed magnetization is required has not been established; it certainly looks like it on the present evidence.