A physicist discovered that the signal from her coaxial cable of length \( \ell = 200 \text{ m} \) did not excite the test circuit inside her experimental apparatus. The cable terminated with a load resistance \( R_L = 50 \Omega \). In order to find the location and the nature of the fault, she sent a short positive pulse of height \( V_i = 0.5V \). She used a function generator with an output impedance equal to the cable impedance \( Z = 50 \Omega \) and watched the signal on the oscilloscope. She found, on the oscilloscope display, the same polarity and same height pulse \( V_r \) after 500 ns from the test pulse.

The coaxial cable is constructed such that the speed of voltage and current waves in the cable is \( 2 \times 10^8 \text{ m/s} \).

(a) Show that the sketch shown below represents the equivalent electric circuit of the experiment. Determine \( V_{\text{eff}} \) in terms of \( V_i \).

\[ \begin{array}{c}
    Z \\
    \downarrow \\
    V_{\text{eff}} \quad \text{RL}
\end{array} \]

(b) Determine the amplitude of the reflected pulse \( V_r \) if the cable has no fault.

(c) What was the nature of the fault (open-circuit, short circuit) and where was it located?