I propose an exploratory study of events of faint diffuse optical emission from the ionospheric *F* region at the red wavelength of atomic oxygen, using a database of low-light-level all-sky imaging observations in the polar cap. Such emissions are frequently observed at Eureka, sometimes in association with the much more commonly observed discrete polar arcs, but they have not been studied up to now because their faintness put them below the sensitivity threshold of imaging detectors until recently. Nevertheless, the characteristics of these emissions identified thus far - a Sun-aligned emission boundary; boundary drift motions correlated with the dawn-dusk component of the interplanetary magnetic field (IMF); occurrence only during extreme auroral oval contraction - identify them as of magnetospheric origin, and as being closely coupled to the magnetospheric boundary layer where energy transfer between the solar wind and Earthspace takes place. A statistical survey is the first step, in order to identify more clearly the chacteristics that have been determined in a preliminary way. This survey will include relevant ground- and space-based observations. Following this survey, a detailed investigation of particular events will be undertaken to determine the following: (a) the excitation mechanism of the diffuse emission, (b) the significance of its morphology and motions, and (c) its location relative to the auroral oval, its position with respect to the boundary between open and closed magnetic field lines, and its place in the ionospheric convection pattern for northward IMF. This study will involve observations from both the ground and space, encompassing optical, magnetic, and radiowave measurements from the ground, and space measurements from satellites both directly above the emission regions, and at great altitudes where a global perspective can be obtained.