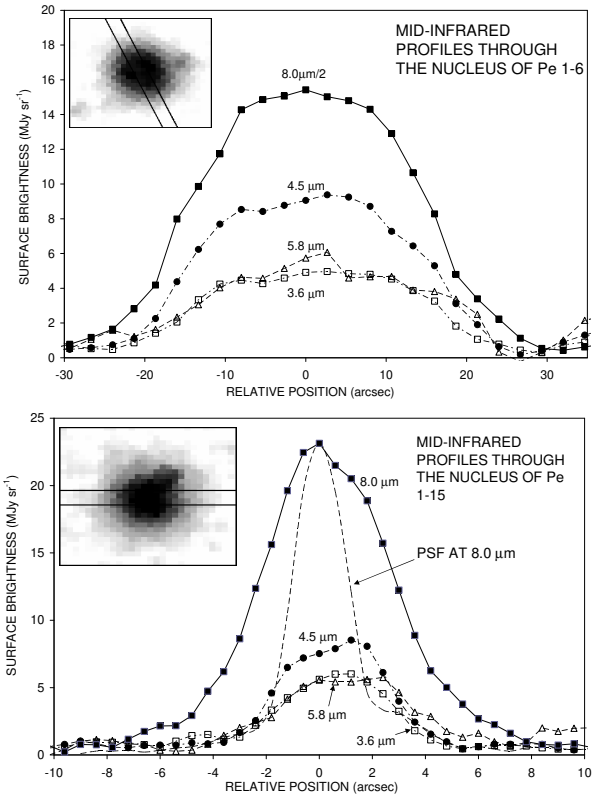

Fig. 28. As for Figure 27, but for Pe 1-6 and Pe 1-15.

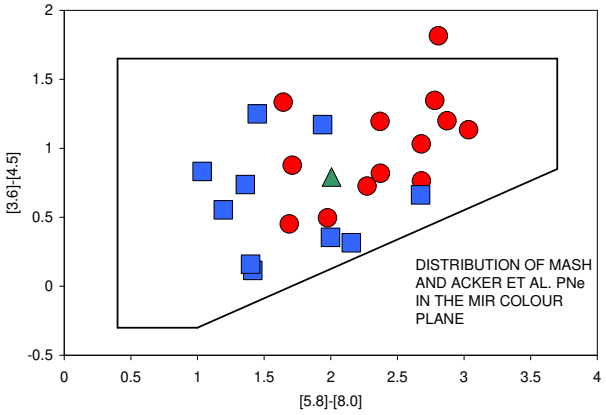

Fig. 29. The distribution of GLIMPSE 3D sources in the [3.6]–[4.5]/[5.8]–[8.0] colour plane, where the Acker et al. (1992) sources are represented as disks, MASH I sources are squares, and the sole MASH II PN is represented by a triangle. The solid lines indicate the approximate limits for Galactic PNe deduced from previous photometry of these sources. There is a tendency for MASH I sources to have somewhat lower indices [5.8]–[8.0], and for the Acker et al. (1992) sources to have larger values for these parameters; a situation which, if confirmed, might indicate a secular evolution in MIR colours.

there is strong shock-excited H_2 emission, higher excitation gas thermal emission, and/or strong dust continua or PAH emission bands. A further interesting aspect of the results is that there appears to be a tendency for the Acker et al. (1992) sources (disks) to have higher values of [5.8]−[8.0]. Specifically, whilst 80% of MASH I sources have indices smaller than [5.8]−[8.0] = 2.05 mag, the corresponding fraction for the Acker et al. (1992) nebulae is closer to 25%. Since the MASH I sources (squares) are normally regarded as being larger, more evolved, and to have lower levels of surface brightness, this may imply that there is an evolutionary trend within the colour plane – a trend which is related to a variation in the strength of the emission mechanisms cited above. It is possible, for instance, that ionic transitions (such as [ArII] λ6.985 μm and [ArIII] λ8.991 μm) become weaker as nebulae evolve, although the reduction of nebular excitation with increasing size, and evolution of the central stars to lower temperatures might be expected to have precisely the reverse effect. It is also conceivable that PAH band excitation becomes less strong as nebulae expand, and that radiative excitation of the molecules decreases. This would affect 8.0 μm band fluxes more than those at 5.8 μm, and lead to decreases in the [5.8]–[8.0] indices. Finally, the paucity of lower [5.8]–[8.0] sources may reflect a bias in the sample, such that the proportion of more evolved PNe is less than in previous studies of these nebulae.

It is clear however that these various mechanisms are no more than possible explanations, and further spectroscopy is required before we can understand such trends.

5. CONCLUSIONS

We have undertaken a provisional survey of PNe detected in the GLIMPSE 3D survey. This has involved mapping the shells in the 3.6, 4.5, 5.8 and 8.0 bands, as well as obtaining profiles through the nuclei, and maps of flux ratio parameters. We have detected many of the signatures discovered in previous mapping of such sources, including increases in the 5.8 μm/4.5 μm and 8.0 μm/4.5 μm ratios with distance from the nuclei, and emission from enveloping PDRs (Pe 2-12, H1-7, M 1-29). We have also detected enhanced levels of emission in the halos of the sources (NGC 6578) when compared to trends observed in the visual wavelength regime. It is therefore clear that the MIR characteristics of the PNe are sometimes radically different from those observed in other wavelength regimes.