We present a deep near-infrared colour–magnitude diagram of the Galactic globular cluster 47 Tucanae (47 Tuc), obtained with the Visible and Infrared Survey Telescope for Astronomy (VISTA) as part of the VISTA near-infrared $Y, J, K_s$ survey of the Magellanic Clouds system (VMC). The cluster stars comprising both the subgiant and red-giant branches exhibit apparent, continuous variations in colour–magnitude space as a function of radius. Subgiant-branch stars at larger radii are systematically brighter than their counterparts closer to the cluster core; similarly, red-giant-branch stars in the cluster’s periphery are bluer than their more centrally located cousins. The observations can very well be described by adopting an age spread of ~0.5 Gyr as well as radial gradients in both the cluster’s helium abundance ($Y$) and metallicity ($Z$), which change gradually from $Y = 0.28$, $Z = 0.005$ in the cluster core to $Y = 0.25$, $Z = 0.003$ in its periphery. We conclude that the cluster’s inner regions host a significant fraction of second-generation stars, which decreases with increasing radius; the stellar population in the 47 Tuc periphery is well approximated by a simple stellar population.

The near-infrared YJK, VISTA survey of the Magellanic Clouds system (VMC; Cioni et al. 2011, A&A, 527, A116) is the most sensitive near-infrared survey of the Magellanic system ever performed. Its photometric depth allows the derivation of the star-formation history with unprecedented quality thanks to the uniform and high-quality photometry reaching stars at the main-sequence turnoff across the entire area and with a reduced sensitivity to differential extinction. We have collected about 60% of the observations; VMC data are processed and analysed regularly. The third public data release, including five tiles of the Large Magellanic Cloud and two tiles of the Small Magellanic Cloud, is now available.

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For more details, see: