The equatorial Pacific mean sea surface temperature (SST) is currently characterized by a strong east-west gradient that is tightly coupled to the thermocline structure. During the mid-Pliocene warm period, the Pacific SSTs resembled a modern-day El Niño event, with the eastern waters ~4°C warmer than today while the western Pacific warm pool was relatively stable. Did a deep equatorial thermocline also contribute to this “El Padre” mean state? Here we use the Mg/Ca-values of subsurface dwelling foraminifera to reconstruct the equatorial thermocline and show the equatorial thermocline was deep during the mid-Pliocene and gradually shoaled to its present position. At ~4 Ma, the thermocline sufficiently shoaled in the eastern Pacific to bring cold water to the surface. This initiated atmosphere-ocean feedbacks that enabled the transition from the warm Pliocene to the cold Pleistocene.