Stephanie,

I will try to give you some clues. Your question is a valid one, as surface lows often form and develop in response to a trough or low in the upper troposphere.

Perhaps, though, the first thing to appreciate is that the surface pressure field (and also that at any level in the atmosphere) comes about as a result of the pressure field at some higher level, plus the intervening thermal field.

This means that the surface pressure field would contain an exact impression of an upper low or trough immediately below the feature if it were not for the intervening thermal field. It is often the case that an upper low or trough is on the lower troposphere cold side of a thermal boundary, with the cold air in the lower troposphere compensating for the lower pressure aloft, perhaps resulting in a surface ridge or high cell co-located with the upper low.

A surface low, then, is the manifestation in the surface pressure field of an overlying warm anomaly. It may be in the lower troposphere near the surface, as in the case of a thermal or heat low over land in summer, or it may be higher in the atmosphere, in which case it could be visible in the pressure pattern at a number of tropospheric levels.

Looking at the life cycle of a mid-latitude surface low, the driving force behind the development is linked to the upper troposphere. If a jet-stream is present, and nearly all surface cyclogenesis in mid-latitudes is associated with a jet-stream in the upper troposphere, changes in vorticity along the flow, associated with curvature in the flow or shear across it, cause accelerations and the linked ageostrophic motion. This means that there is a component of the flow which is normal to the isobars at its level, and this sets up an transverse circulation throughout the troposphere, which when looking along the jet axis in the downwind direction, is clockwise at the jet exit and anti-clockwise at its entrance. This in turn leads to thermal advection which near the surface is in the sense that warm air is advected towards cold below the exit, and vice-versa below the entrance. Both effects tend to strengthen any pre-existing thermal boundary (front).

If we take an example where an existing upper tropospheric low is developing in response to dynamic effects around the tropopause, and it has a jet stream on its southern flank, the conditions will exist for lower tropospheric warm advection near the jet exit. This can result in a warm thermal anomaly bulging towards the colder air, and in so doing, advecting across upper level pressure contours towards lower values. Below the thermal anomaly pressure will be preferentially lower, and can fall further if changes in advection are supportive, and a surface low will develop. If the upper low develops further, there will be an associated downwind ridging at the same level and the flow ahead of the upper low at all levels through the troposphere will back in response, enhancing the advection of the warm thermal bulge at lower levels, which is finding itself under lower upper pressure contours due both to advection and falling pressure at upper levels. As the circulation of the surface low increases, cold air advects from the rear quadrant and penetrates and surrounds the centre and the warm thermal bulge gets pinched out and migrates ever further from the low centre on the southeast side of the low. From the perspective of the low level thermal field, relative to the low centre we find ever decreasing thickness values, which will halt the deepening process unless the developments of the upper low are sufficient to cause the pressure at upper levels above the surface low to continue to fall, and at a rate sufficient to offset the thermal cooling over the low level centre at lower levels, a condition which is frequently achieved. Finally, the whole of the lower troposphere in the vicinity of the surface low will contain relatively uniform cold air, and the upper low becomes the dominant factor in dictating the location of the low at other levels throughout the troposphere, the upper and surface lows are then co-located. Variations of this theme will be evident where airmass modification change the thermal field in the troposphere, for example, when very cold continental air is advected over a warm sea in a cyclonic circulation, and the resulting deep convection redistributes heat and moisture from the sea through the troposphere.

Looked at from the perspective of the surface low centre, we see that at first the lower tropospheric positive thermal anomaly is the deciding factor as to its location, but as time passes

thickness values above the centre decrease while those at levels in the upper troposphere and lower stratosphere increase. The exact track that the surface low takes will depend on the timing of events and the strength of the upper tropospheric development.
The occlusion process in all this is secondary, and is just the natural response to the inevitable overtaking of the initial low level thermal anomaly by colder air in the developing low level circulation, once the low level warm anomaly is no longer co-located with the surface low. Quite often, the development in the lower troposphere is sufficiently rapid for a strand of the occluded warm air to become engaged within the cyclonic circulation, and can spiral around the low centre completely, sometimes more than once. However, the warm anomaly associated with the occlusion is usually insufficient to greatly influence the surface pressure field.

And a word about the upper troposphere.
Troughs and lows in the upper troposphere generally have their maximum amplitude just below the stratosphere, near the tropopause. The amplitude thus decreases both upwards and downwards from this level. If we look at the situation from some level in the stratosphere where the amplitude of the feature associated with the tropospheric trough is vanishingly small, and we regard this as the unperturbed level, then the pressure pattern in the upper troposphere will bear the imprint of that at the unperturbed level plus the imprint of the thermal pattern in the region of the stratosphere between this level and the upper troposphere. Thus we find that all upper tropospheric lows and troughs are overlain by relatively warm air (positive thickness anomaly values), and ridges and highs by relatively cold air (negative thickness anomalies). As a low or trough in the upper troposphere imprints changes in vorticity on the flow in their vicinity, and as changes in vorticity are coupled to stretching and contraction of vertical columns of air at that level, there exists a feedback mechanism whereby air that experiences increasing vorticity along the flow (negative vorticity advection), causes the stratospheric air to descend in this region. Because the stratosphere is normally strongly stabilised, any vertical motion there will have a maximum effect on the temperature (thickness) in those layers involved, thus areas having already a positive thickness anomaly can have this anomaly increased, but by an amount that depends on the degree of vorticity change, which in turn is linked to the upwind conditions and any changes taking place there. Similarly, as air flows downwind from the trough or low, the changes in vorticity (now positive vorticity advection) will lead to upward vertical motion in the stratosphere, assisting in maintaining or increasing the negative thickness anomaly there.

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