Congruence lattices that force nilpotence

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It is well known that an algebra with permuting congruences and $M_3$ as its congruence lattice is abelian. We present a condition on the congruence lattice that forces a finite algebra with a Mal’cev term to be nilpotent. For expanded groups, we prove that if this condition fails, then the algebra has a non-nilpotent expansion with the same congruence lattice.

Another condition on the congruence lattice tells when the expansion of the algebra with all its congruence preserving functions is supernilpotent.