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(tmattman@csuchico.edu). *Graphs on 21 edges that are not 2-apex.*

It is known that an intrinsically knotted (IK) graph cannot be 2-apex but to what extent can the effort to catalogue forbidden minors to the 2-apex property be used towards determine the minor minimal IK (MMIK) graphs? We focus on the case of graphs with at most 21 edges and show that the smallest obstruction set to the 2-apex property is exactly the Heawood family of graphs, that is, graphs obtained through  $\Delta Y$  and  $Y\Delta$  moves from  $K_7$ . As a corollary, we get a new proof that the MMIK graphs with at most 21 edges are those obtained by  $\Delta Y$  moves from  $K_7$ .

On our way to this result, we discuss obstructions to apex graphs and show that, for graphs on 16 or fewer edges, this can be characterized by the Petersen family of graphs. (Received August 25, 2015)