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Fix a prime number  $\ell$ . Graphs of isogenies of  $\ell$ -power degree are well-understood for elliptic curves, but not for higher-dimensional abelian varieties. We study the case of ordinary abelian varieties over a finite field of characteristic  $p \neq \ell$ , with a particular focus on principally polarized surfaces. We analyse graphs of so-called  $\mathfrak{l}$ -isogenies, showing that they are (almost) volcanoes. In the case of abelian surfaces, we can further describe graphs of isogenies whose kernels are maximal isotropic in the  $\ell$ -torsion. Among applications to cryptography is a “surfacing” algorithm in genus two, which computes an isogeny from an arbitrary ordinary abelian surface to one whose endomorphism ring is the maximal order in its endomorphism algebra. This is joint work with Dimitar Jetchev and Benjamin Wesolowski. (Received September 13, 2016)