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How tough is tuff in the event of fire?

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Tuff has been extensively used as a building material in volcanically and tectonically active areas over many centuries, despite its inherent low strength. A common and unfortunate secondary hazard accompanying both major volcanic eruptions and tectonic earthquakes is the initiation of catastrophic fires. Here, we report new experimental results on the influence of high temperatures on the strength of three tuffs that are commonly used for building in the Neapolitan region of Italy. Our results show that a reduction in strength was only observed for one tuff, the other two were unaffected by high temperatures. The cause of this strength discrepancy was found to be a product of the initial mineralogical composition, or, more specifically, the presence of thermally-unstable zeolites within the initial rock matrix. The implications of these data are that, in the event of fire, only the stability of buildings or structures built from tuff containing thermally-unstable zeolites will suffer. Unfortunately, this includes the most widespread dimension stone in Neapolitan architecture. We recommend that this knowledge should be considered during fire hazard mitigation in the Neapolitan area and that other tuffs used in construction worldwide should be tested in a similar way to assess their fire resistance.