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An Alternative Model for “Pingo” Formation in Permafrost Regions

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Pingos are a characteristic geomorphologic feature of certain Arctic regions in which dome-shaped dimples can form in the permafrost layers of otherwise flat landscapes. It is widely accepted that the formation of a “pingo” results from the development of an excess pore water pressure in the unfrozen ground, the “talik”, underlying the permafrost layer. This paper argues that these prevailing models for pingo formation contain some serious mechanical inconsistencies. An alternative model is postulated. It relies upon the development of high levels of in-plane compressive stress in the permafrost layer. These compressions would arise from the restraint to the expansions otherwise occurring when in a thickening of the permafrost layer water turns to ice and/or when the ice in the permafrost layer is subject to a seasonal increase in temperature. An upheaval buckling under these conditions is consistent with the local dimples associated with pingos.

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