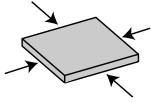


# WATERBOMB



**Natural Folding:**  
*Bi-directional  
compression*

Traditional: Japanese origami base, used to create a 'ball' or 'waterbomb'. The tessellation was discovered by numeric analysis by Tanizawa and Miura [1] and described as natural folding by Biruta Kresling [2].

## References:

1. Tanizawa, K., K. Miura (1978). *Large displacement configurations of bi-axially compressed infinite plate*, Trans. Jap. Soc. Aer. Space Sci. 20, 177–187.
2. Kresling, B. (2012). *Origami-structures in nature: Lessons in designing "smart" materials*. MRS Proceedings, 1420, mrsf11-1420.34(9), 141–163.



<https://orilab.art/natural/waterbomb>

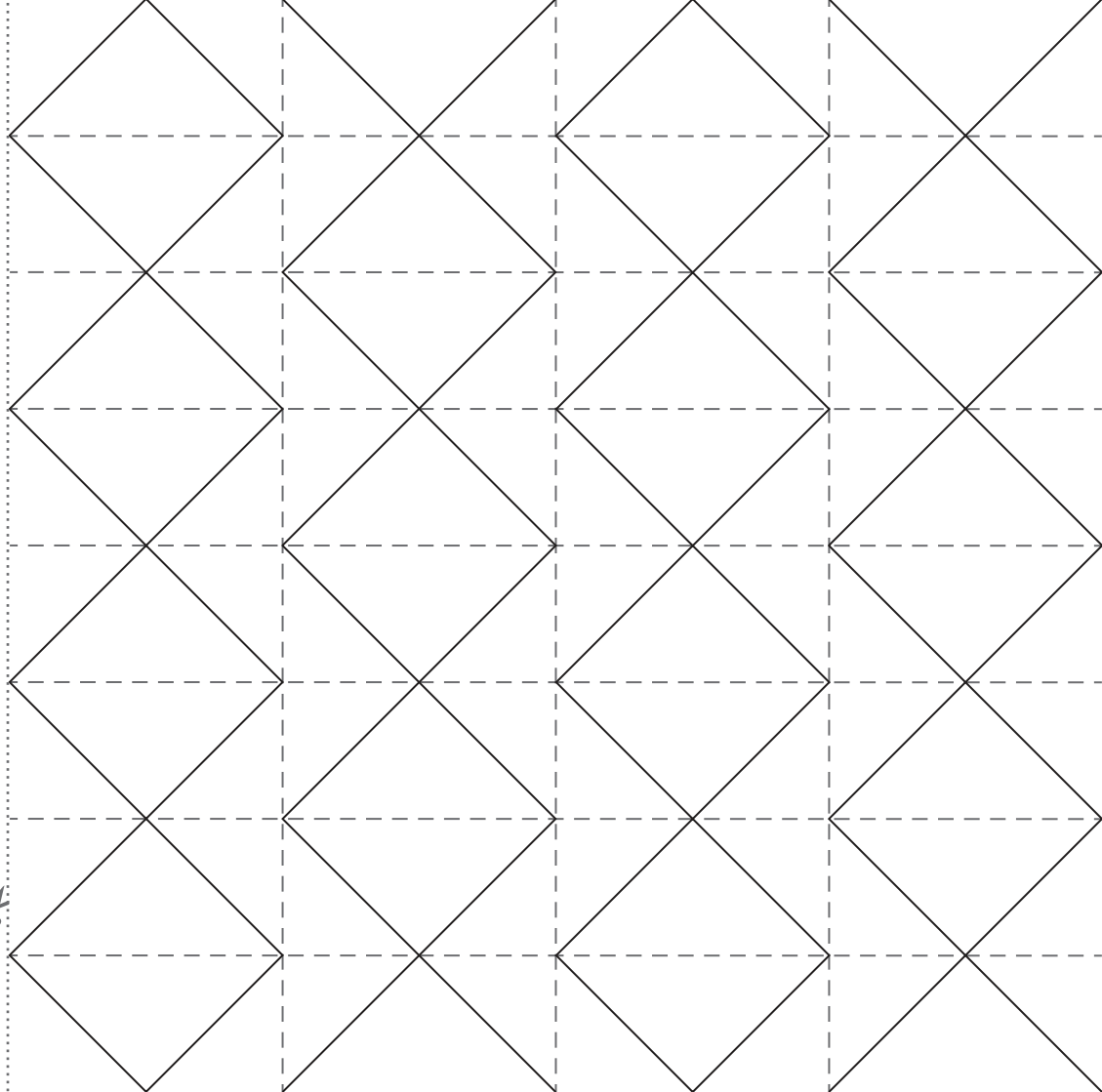
mountain

valley

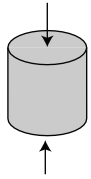


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# YOSHIMURA



**Natural Folding:**  
*Cylinder with  
axial compression*

Discovered in crumpling patterns of aircraft wings by Yoshimaru Yoshimura [1]. The pattern emerges in the sleeves of shirts, on rolls of paper and especially in rolls of textiles. Used in Japan as decorative and structural element in aluminium drink cans [2].

## References:

1. Yoshimura, Y. (1955). *\*On the mechanism of buckling of a circular cylindrical shell under axial compression\** (Technical Memorandum 1390). National Advisory Committee for Aeronautics.
2. Miura, K. (1969). *Proposition of Pseudo-Cylindrical Concave Polyhedral Shells*. ISAS Report, 34(9), 141–163.



<https://orilab.art/natural/yoshimura>

mountain ———

valley - - - - -

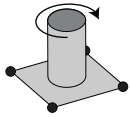


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# FLASHER



## Natural Folding:

*Rotation of a cylinder  
or polygon on a sheet*

The flasher was designed and named by Californian origami artists Jeremy Shafer and Chris Palmer [1]. The most common application is for wrapping solar sails. NASA engaged origami experts and engineers, including Robert Lang, to design an origami-based solar array [2].

### References:

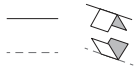
1. Shafer, J. (1995). *Flasher*. BARF 1995 Spring. Bay Area Rapid Folders Newsletter. Jeremy Shafer.
2. Zirbel, S. A., Lang, R. J., et al (2013). *Accommodating thickness in origami-based deployable arrays*. Journal of Mechanical Design, 135(11).



<https://orilab.art/natural/flasher>

mountain

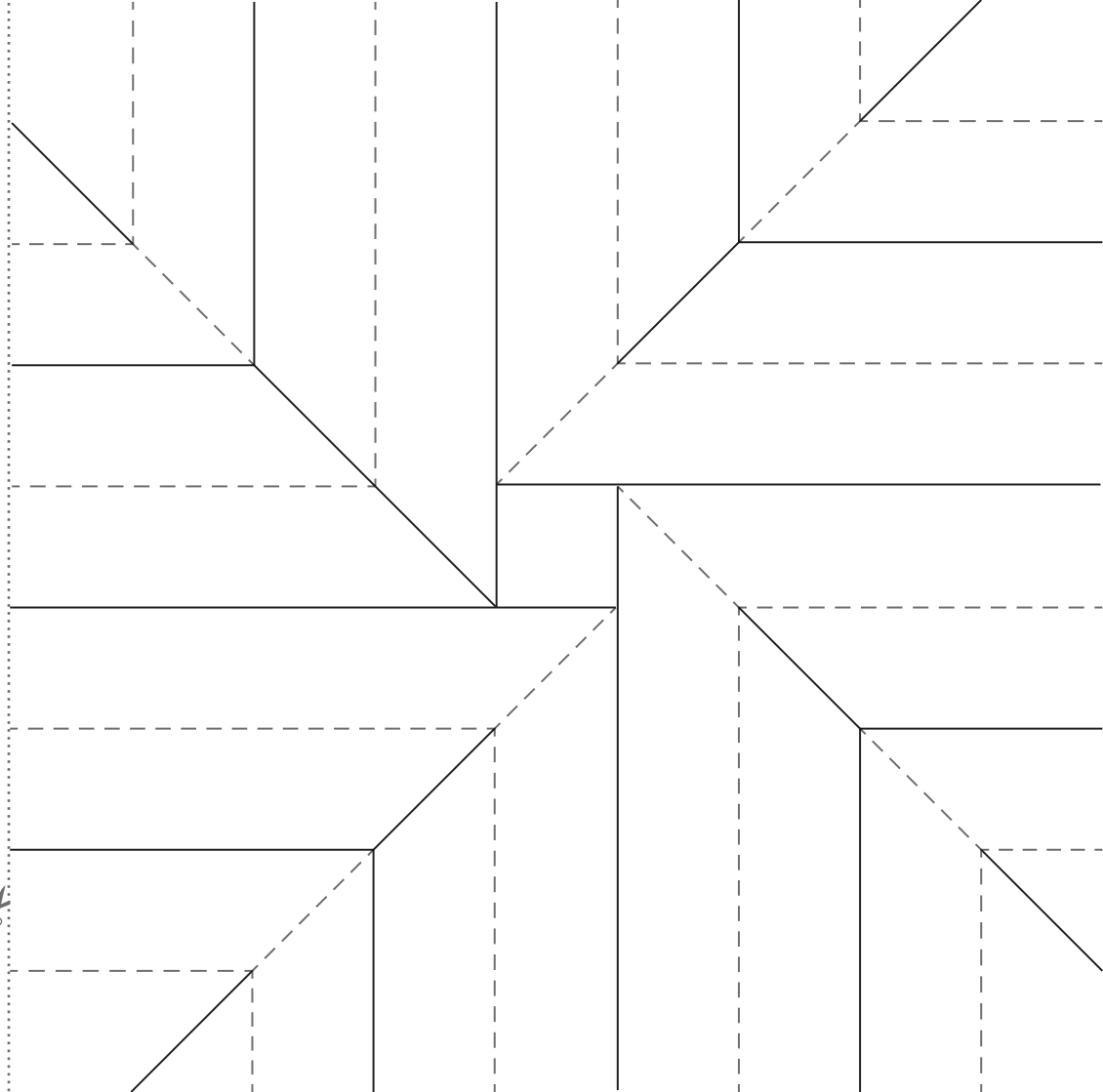
valley



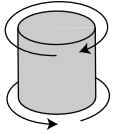
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# KRESLING



**Natural Folding:**  
*Cylinder with  
axial compression*

The discovery of the natural folding method can be attributed to Biruta Kresling [1]. The pattern is highly adaptable and has two primary forms, a spiral form that acts like a screw mechanism and an opposed form that results in a net-zero rotation during compression.

## References:

1. Kresling, B. (2008). *Natural Twist Buckling in Shells: From the Hawkmoth's Bellows to the Deployable Kresling-Pattern and Cylindrical Miuraori*. In J. F. Abel & R. Cooke (Eds.), *Proceedings of the 6th International Conference on Computation of Shell and Spatial Structures, IASS-IACM 2008*.



<https://orilab.art/natural/kresling>

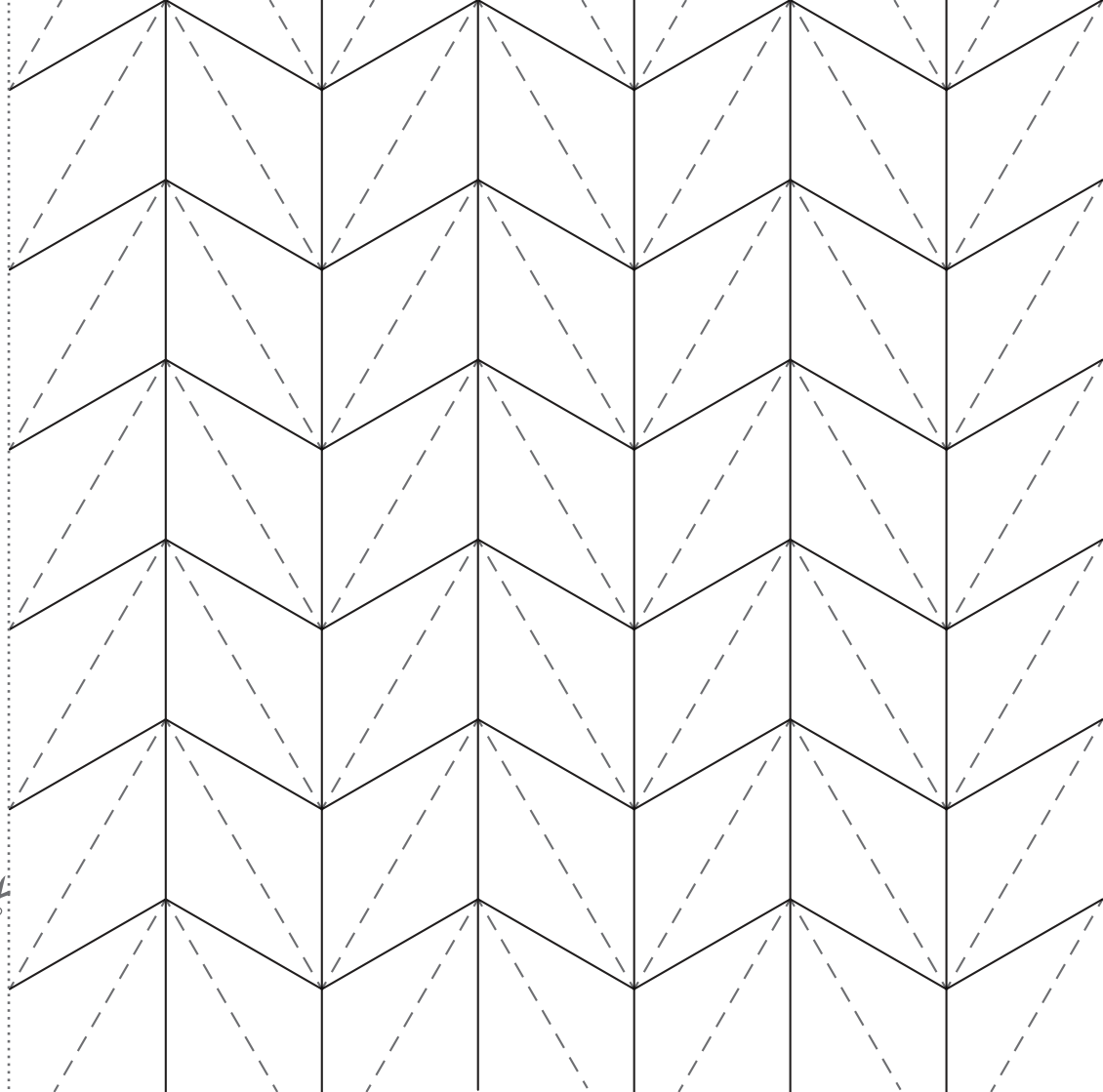
mountain ———

valley - - - - -

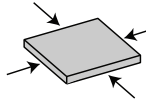


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# MIURA



**Natural Folding:**  
*Bi-directional  
compression*

Professor Koyro Miura discovered the Miura-ori and other folding patterns by simulating the crumpling of materials under compression from two directions [1]. However, the pattern can be found over 400 years earlier in the origami-like collar seen in *Portrait of Lucrezia Panciatichi of Uffizi* by artist Bronzino [2].

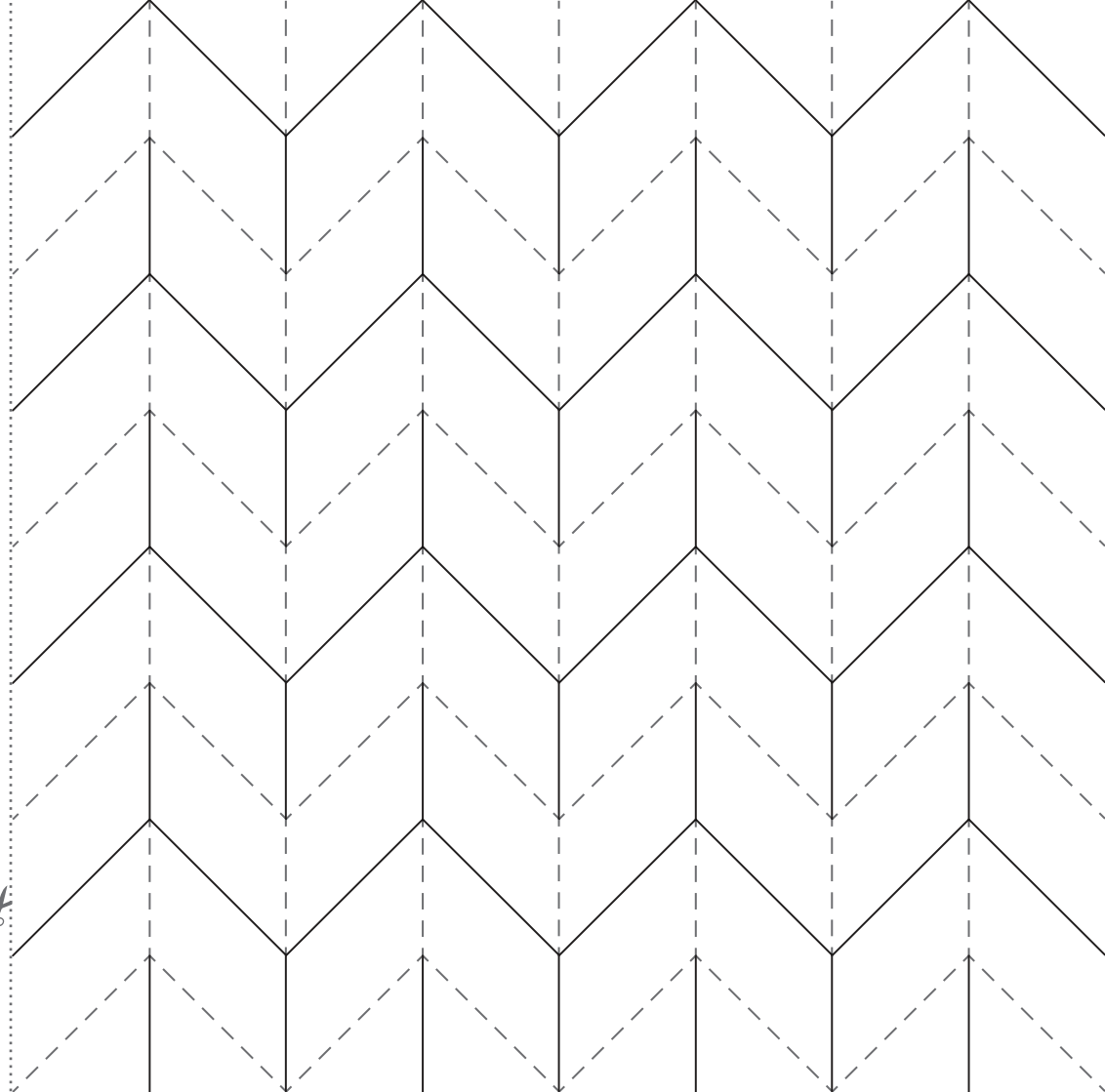
References:

1. Miura, K. (1985). *Method of packaging and deployment of large membranes in space*. 31st Congr. Int. Astronaut. Federation, IAF- 80-A 31 Tokyo, 31st Congr. Int. Astronaut. Federation, IAF-80-A 31 Tokyo, 1–10.
2. *Portrait of Lucrezia Panciatichi*, oil on panel, Agnolo di Cosimo, Bronzino, circa 1545. Uffizi Gallery, Florence, Italy.



<https://orilab.art/natural/miura>

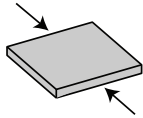
mountain ———  
valley - - - - -



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# PLEAT



## Natural Folding:

*Flat with bi-directional force, up and down.*

In technology, the folded mechanics of bellows made it possible for the first time to produce enough heat for forging, smelting, and welding metal. Also, the pleat allowed the camera bellows to shield light while remaining transportable and provides the accordion and concertina their musical breath.

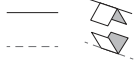
Can you work out how a bellows can be folded from a pleat?



<https://orilab.art/natural/pleat>

mountain

valley



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