

VIGIE-CIEL, A CITIZEN SCIENCE PROJECT ABOUT METEORS, METEORITES AND CRATERS.

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Introduction: Meteorites in France have always been recovered by the general public. FRIPON, a fireball observation network [1] now covers France and is developing in Europe and in Canada (www.fripn.org). It detects fireballs and allows us to calculate meteorite strewn fields within 24 hours so that searches can be launched very early on and meteorites can be recovered before they alter significantly. Because of the need to search everywhere, including in private land, it is important that the general public be aware of the scientific value of meteorites and willing to contribute to helping us find them on the ground. Vigie-Ciel (www.vigie-ciel.org) is the citizen science counterpart of the FRIPON network. It also invites the general public to participate in the detection of fireballs (www.vigie-ciel.imo.net – a fruitful collaboration with the American Meteor Society) and the identification of impact craters on Earth based on shaded relief images (www.vigie-crater.org). As participation is more effective if the people involved are informed and trained, Vigie-Ciel also contributes to scientific education on meteors, meteorites and impact craters and, more generally, in planetology.

Searching for meteorites: Searching for a meteorite on the ground is not an easy task. Several test campaigns have allowed us to identify the main issues that have to be dealt with. These are related to: (1) the respect of legislation, private property and the inhabitants of the area; (2) the logistical aspects in order to have well-coordinated groups of a reasonable size in the field; (3) the implementation of an efficient communication towards the general public, but also towards the local authorities and the inhabitants of the area. If, for the time being, no meteorites have been found in France through the efforts of FRIPON/Vigie-Ciel, three meteorites have been recovered in the neighboring countries (Cavezzo in Italy [2], Winchcombe in England [3] and Kindberg in Austria [4]) with a contribution of FRIPON equipment and/or through the search methods that were designed by the FRIPON/Vigie-Ciel teams. As in earlier times, all these discoveries involved curious citizens who reached out to scientists, but at least two new factors were also implicated: (1) observations by a professional and/or an amateur camera network which led to a computation of the strewn field and (2) multiple communication channels through the press, the social networks and specially designed leaflets.

The Vigie-Ciel network and tools: Information and training of potential participants is an essential part of the Vigie-Ciel program and we are still working at improving it with the help of our national, regional and local partners who also play a major role in setting up the field search campaigns when a meteorite is deemed to have fallen in a neighboring area. Such campaigns could not be set up without their active help and their knowledge of the local territory. These partners, who come from various contexts, are often involved in scientific outreach. They comprise planetariums, natural history museums, astronomy clubs, but also schools, village or town halls... and a large fraction of them also host a FRIPON camera. The Vigie-Ciel National Team offers them training, support and tools – which are still being improved – to perform these tasks. The pedagogic tools we developed include exhibits, a field search training protocol and a set of suitcases containing meteorites, meteorite samples and various tools to study the properties of rocks, which has been reproduced 22 times and distributed in France in the former (smaller) administrative region. These pedagogic suitcase sets are designed to be used by our partners to train interested amateurs and/or to be lent to other structures who wish to become local partners of the project (after they have received a training). So far, the National Team has trained about three times as many instructors as the number of suitcase sets and these, in turn, have the ability to coach new trainers and animators and to organize public outreach events.

Conclusion: Vigie-Ciel is a citizen science project designed in France to invite the general public to contribute to studying the flux, origin and nature of extraterrestrial materials that reach the surface of the Earth. Its original focus was on recovering meteorites whose fall was detected by the FRIPON camera network. However, citizens can now contribute in various other ways, which include searching for previously undetected terrestrial impact craters on the Vigie-Crater website, reporting fireballs and hosting a FRIPON camera.

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