OpticalMine

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Introduction

OpticalMine is an educational software for introducing the students in the optical mineralogy techniques. It studies theoretically the optical properties of transparent minerals, and shows the user how to evaluate each of these properties just as he would do in the identification of minerals using the petrographic microscope. The most commonly used method for studying the rocks and soils forming minerals consist in examining the optical properties shown by minerals with a polarising, or petrographic, microscope.

This software belongs to a course developed for the soil-genesis teaching, in which the contribution of the soil mineralogy is specially attended. Some computer other programs of this course are presented in this Eurosoil 2004: SoilMicroscopy, IlluviaSols, CO_3Sols and HydroSols.

The application

OpticalMine has been re-worked using the heterogeneous (Windows, Mac, Linux, etc) languages HTML and JavaScript from a first version implemented in Hypertalk for Apple Macintosh computers, which was presented in the 10th International Working Meeting on Soil Micromorphology (Dorronsoro et al., 1996) and in the 16th World Congress of Soil Science (Dorronsoro et al., 1998).

The program is available in both English and Spanish versions and it can be found at:

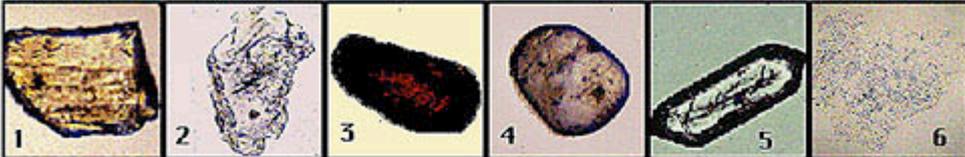http://edafologia.ugr.es/optmine/indexw.htm

OpticalMine is a composed of texts, figures, microphotographs and movies, which are taken under different working conditions (polarized light, with and without analyzer, and orthoscopic or conoscopic illumination). The user will have to answer some questions concerning the identification of a mineral, which is shown in a picture. Thus, the software evaluates the knowledge of the student.

The presented software allows both the self-learning of the students and their self-evaluation. For the self-evaluation of the knowledge acquired by the student, test suite is provided. Additionally, the students can be calificated with this software; the highest score is 10 points and each wrong answer is penalized by two points (Figure 1).

Figure 1. Test model to evaluate the relief degree.

The control of right and wrong answers has been implemented with a JavaScript algorithm, which is inserted into the HTML code.

Some scripts related to the Figure 1 are given below.

Script 1

```
<HTML>
<HEAD>
<TITLE>PaginaBaseTest A</TITLE>
</HEAD>
<BODY>
<SCRIPT LANGUAGE="JAVASCRIPT">
var textPreg = " Questions: "
var textAciertos = "\r Correct answers: "
var textFallos = "\r Failures: "
var fallados = 0
```

```
var contador = 1
var nota = 10
var notificar = "\rMark: "
function WinOpen(nombre){
open(nombre,"Window1","toolbar=no");
}
function empezar(){
swith (contador) {
case 1: WinOpen("testa1w.htm");
        break;
case 2: WinOpen("testa2w.htm");
        break;
case 3: WinOpen("testa3w.htm");
        break;
case 4: WinOpen("testa4w.htm");
        break;
case 5: WinOpen("testa5w.htm");
        break;
case 6: WinOpen("testa6w.htm");
        break;
case 7: WinOpen("testa7w.htm");
        break;
case 8: WinOpen("testa8w.htm");
        break;
default;
alert("This test is finished.\rThe results are:\r" + textPreg + (contador -1)  + textAciertos +
(contador - fallados - 1) + textFallos + fallados + notificar + nota);
}
</SCRIPT>
<P><FONT SIZE="+1">6 grains are shown which must be ordered in a sequence of
increasing relief (8 questions in this test).</FONT></P>
<P> </P>
<FORM>
<P><input type="button" name="WindowButton1" value= "questions" onclick="empezar()">
 <input type="button" name="WindowButton2" value="mark" onclick="alert(textPreg +
(contador -1)  + textAciertos + (contador - fallados - 1) + textFallos + fallados) + notificar +
nota"></FORM>
```

Script 2

```
<HTML>
<HEAD>
 <TITLE>Relief. Test A. n&ordm; 1</TITLE>
</HEAD>
<BODY>
<SCRIPT LANGUAGE="JAVASCRIPT">
function DisplayItem (respuesta){
if (respuesta=="624153")
{alert("The answer is correct");
}
else {alert("Failure!"); self.close();
window.opener.fallados=window.opener.fallados+1;
window.opener. nota=window.opener. nota-2 ; self.close();}
}
function pulsado(form){
if (window.opener.contador==1)
DisplayItem(form.respuesta.value)
window.opener.contador=window.opener.contador+1
}
else self.close()
}
```

```
</SCRIPT>
<P ALIGN=CENTER><B><FONT SIZE=+3>Relief. Test type A . n&ordm;1 </FONT>
</B></P>
<P ALIGN=left><font size="4">6 grains are shown which must be ordered in a sequence of
increasing relief (8 questions in this test).</font></P>
<P ALIGN=CENTER><IMG SRC="relvsel1.gif" WIDTH="600" HEIGHT= "100" ALIGN=
"BOTTOM" NATURALSIZEFLAG="3"></P>
<P><FONT SIZE=+1>Are we capable of distinguishing the different degrees of relief?
</FONT></P>
<P><FONT SIZE=+1>What is the order, from lowest to highest relief?</FONT> </P>
<P><FONT SIZE=+1>Write the numerical sequence in the order you consider correct, without
any punctuation, and press &quot;Enter&quot;.</FONT></P>
<form>
<P><INPUT TYPE="text" SIZE="20" NAME="respuesta" onblur=
"pulsado(this.form)"></P>
</form>
<SCRIPT LANGUAGE="JAVASCRIPT">
document.write ("Number of the question: " + (window.opener.contador - 1))
document.write ("<P>Number of failures: " + window.opener.fallados)
</SCRIPT>
<P ALIGN=CENTER><A HREF="../../index.htm"><FONT SIZE=+1> Index </FONT> </A>
<FONT SIZE=+1> | <A HREF="../../intro/introd.htm">Introduction</A> | <A HREF=
"../ppl.htm">  PPL</A> | <A HREF="../reindex.htm">Relief</A> | <A HREF="../rtest.htm">
Test </A> </FONT>
</BODY>
</HTML>
```

A specific high-security navigator (soile v.1.0) has been developed to examine students; our navigator does not allow some non-desired options of usual navigators (navigator menu, refresh of the current page, access to the source code, access of the history of visited pages, etc), and it provides automatic recording of the results (Figure 2).
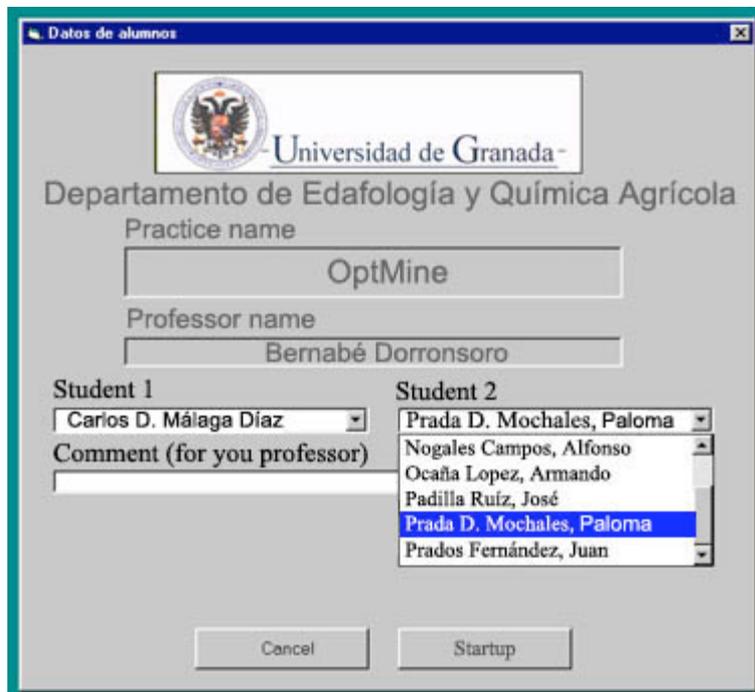

Figure 2. Configuration options.

Our application is composed by 929 pages, containing 327 pictures and 96 movies, and its size is 271 MB.

The program is arranged in four parts.

The first part is an introduction in which different aspects related to the petrographic microscope, the polarized light, and the techniques of carrying out thin sections are treated.

In the second part, the properties studied only with polarizator (PPL=plane polarized light) are studied: relief, colour, pleochroism, habit and cleavage.

In the third part, the analyzer with orthoscopic illumination is introduced. The properties analyzed are: interference colour (birefringence), extinction angle, sign of elongation and twinning.

Finally, the properties observed with polarizer and analyzer using conoscopic illumination are treated: interference figure and optic sign (Figure 3).
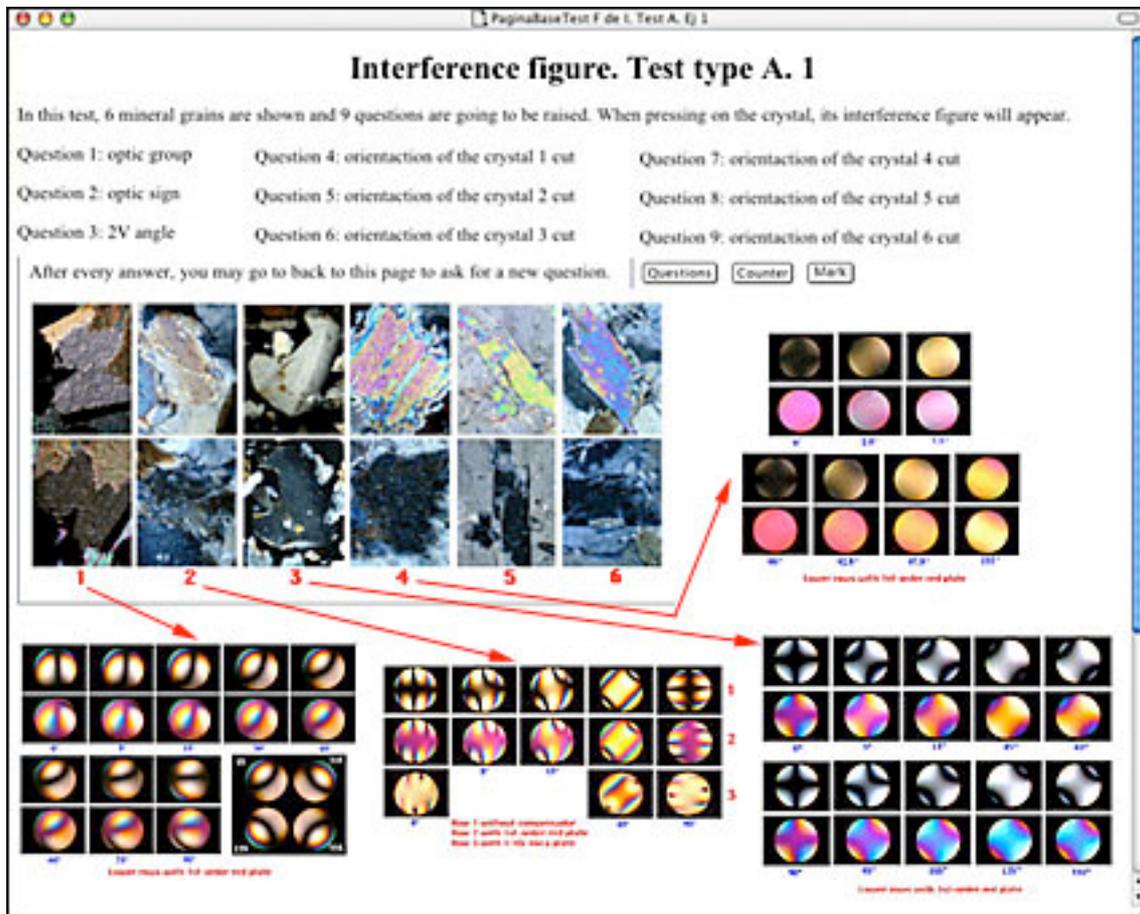

Figure 3. Test for interference figures.

Didactic evaluation

The program has been evaluated by a group of students and the results are summarized in Table 1. The evaluation reveals the high acceptance and the good marks obtained, so the method is considered as highly effective.

Acceptance by the student	
Evaluation of the practices	
Very satisfied	68 %
Satisfied	20 %
Acceptable	9 %
Disagreement	2 %
Very disagreement	1%
No opinion	0 %
Attainment of objectives	
Totally	24 %
Enough	30 %
Sufficient	28 %
Scarce	17 %
Null	0 %
No opinion	1 %
Marks obtained	
First class	23 %
Second class	44 %
Pass	21 %
Fail	12 %
Population	98 students

Table 1. Results of the evaluation test made by the students.

The immediate availability of microscopic images representing the various minerals reduces learning time to a minimum. The number and quality of the images and the extremely fast manipulation of information makes this technique particularly suitable for providing a personalized and highly efficient means of learning.

This programme, when used in conjunction with traditional practices using the optic microscope, frees the teacher from routine and repetitive work, and reduces the maintenance expenses of optic equipment (microscopes and accessories) and material (thin sections) to a minimum.

References

Dorronsoro, C.; García Navarro, A.; Bravo, A.; Alonso, P. 1996. Interactive Computer Programme for Self-Teaching Optical Mineralogy. 10th Int. Working Meeting on Soil Micromorphology. Moscow. Russia.

Dorronsoro Díaz, C.; Dorronsoro Díaz, B.; Dorronsoro Fdez, C.; García Navarro, A. 1998. Optical Mineralogy. 16th World Congress of Soil Science. Montpellier. France.