

STRABOMICRO

USER GUIDE

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1 Introduction

1.1 Overview of the StraboSpot Ecosystem

The StraboSpot ecosystem is a suite of interconnected applications and software tools designed to support the collection, management, integration, and sharing of field and laboratory data in the geosciences. Its primary objective is to align data practices with the FAIR principles: Findable, Accessible, Interoperable, and Reusable, by providing a unified system for managing multidisciplinary geologic data.

Developed through ongoing community input, the StraboSpot ecosystem includes several specialized applications: **StraboField**, which supports workflows in structural geology, petrology, sedimentology, and tephra volcanology; **StraboMicro**, the modern rewrite of the original StraboMicro application, which facilitates microscopy-based geoscience research with enhanced performance and new capabilities; and **StraboExperimental**, which serves the experimental deformation community. Each of these platforms utilizes controlled vocabularies developed by their respective scientific communities to promote standardized data collection and to improve the discoverability and interoperability of geologic data.

StraboSpot offers more than just a centralized data repository, it also includes tools for capturing and organizing field and laboratory observations, including images. The system is built around the concept of *spots*, which represent observations applied across defined spatial scales. This hierarchical structure allows users to nest observations from the regional to the microscopic scale and to organize data and images according to their specific workflow needs. This flexible framework enables users to capture and relate geologically complex information in a coherent and connected manner.

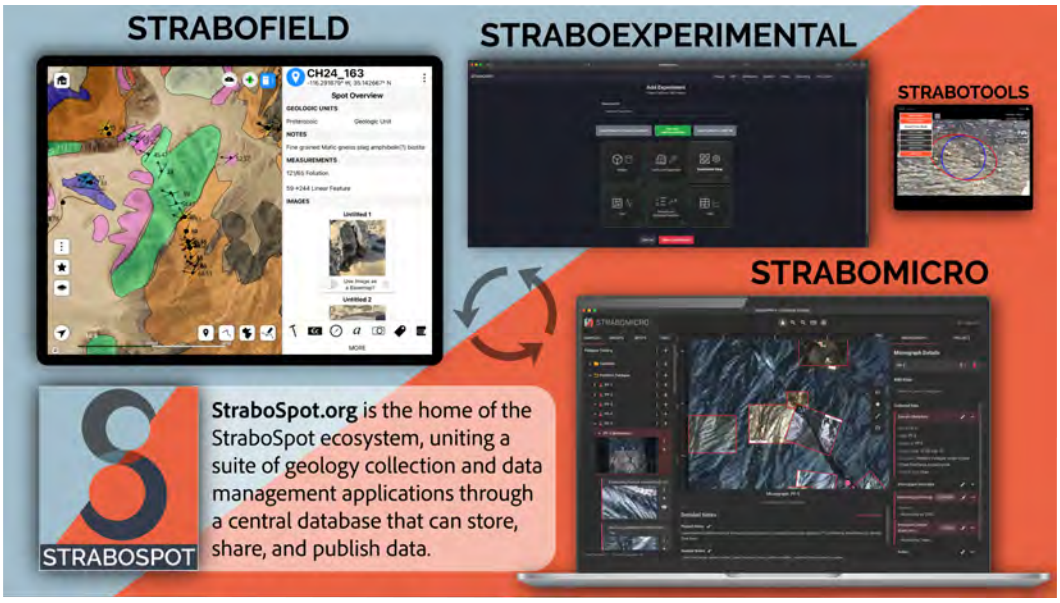


Figure 1. The StraboSpot ecosystem: StraboField, StraboMicro, and StraboExperimental are all connected to the database at StraboSpot.org

1.2 StraboMicro: A Modern Platform for Microscopy-Based Geoscience Research

StraboMicro 2 is a complete overhaul of the original StraboMicro desktop application, rewritten using modern technologies for better performance, reliability, and user experience. Designed specifically for microscopy-based workflows in geoscience research, StraboMicro provides an image-centric organizational structure that enables users to efficiently manage and annotate micrographs while preserving spatial relationships and associated scientific metadata. Projects created with the original StraboMicro open in StraboMicro 2, and the two use the same project format.

Modern Architecture

StraboMicro is built on a modern Electron + React technology stack, providing:

- **Cross-Platform Support:** macOS, Windows, and Linux from a single codebase.
- **High-Resolution Image Support:** smooth panning and zooming of very large micrographs (100MB+ TIFF files), using tiled rendering.
- **Level-of-Detail Rendering:** associated micrographs stay sharp at any zoom level.
- **Many New Tools:** AI grain detection, point counting, grain size analysis, StraboTools, sketches, Custom User Data from your own spreadsheets, version history, and sync and collaboration with StraboSpot.

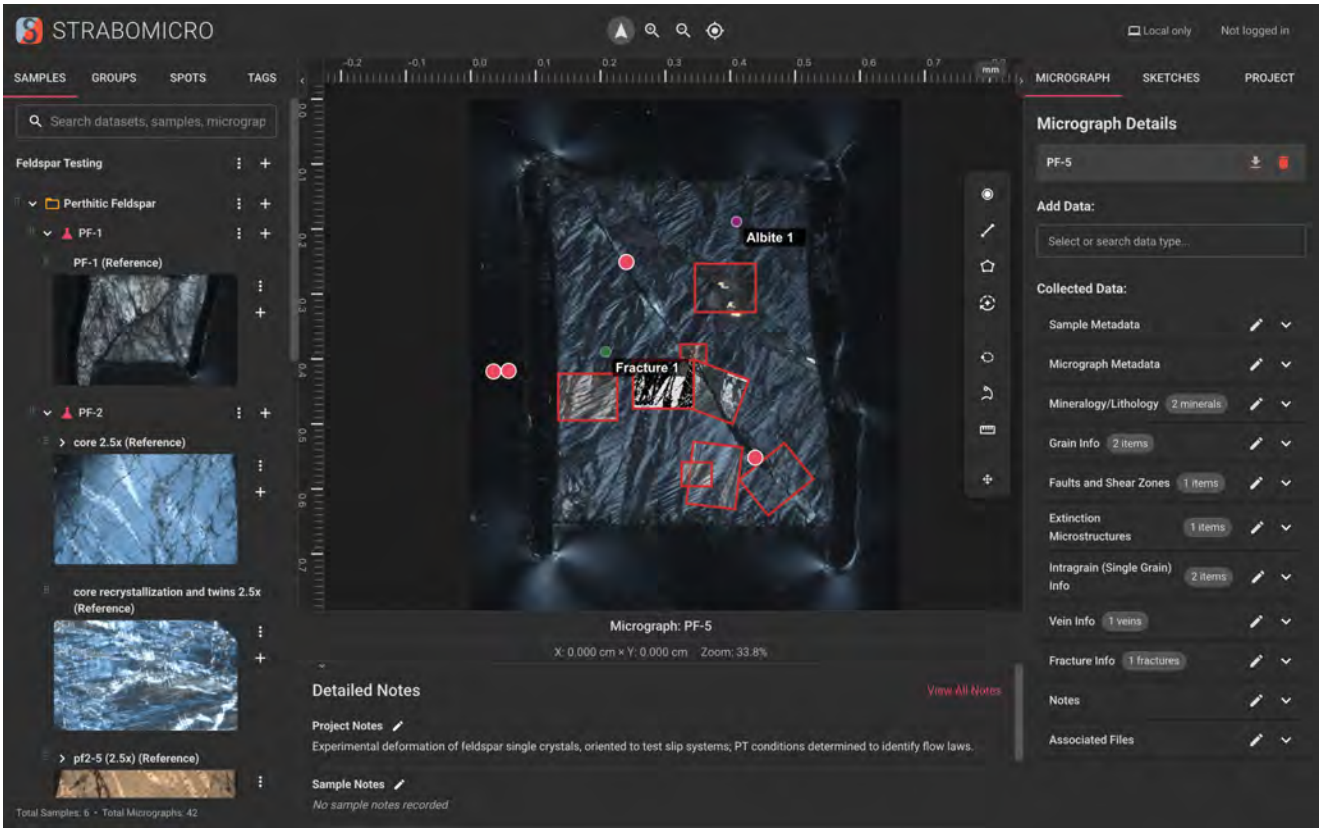


Figure 2. StraboMicro main interface showing the standard layout with left navigation pane, micrograph viewer, and right side properties pane

Core Functionality

StraboMicro allows users to create and manage projects composed of geological samples. Each sample includes:

- **Reference Micrographs:** Typically lower magnification, full-sample scans or stitched images that provide contextual overviews.
- **Associated Micrographs:** Higher magnification micrographs of the sample, often collected using different imaging techniques or instruments. These are placed precisely on their parent micrograph using several location and scale methods, including 3-point registration.

Geoscience-Specific Metadata

A key feature of StraboMicro is its ability to link spatial image data with detailed geoscientific metadata. Users can add metadata at the project, dataset, sample, micrograph, and spot levels. Geologically meaningful metadata and data include:

- Mineralogy and Lithology
- Grain Size, Shape, and SPO
- Fabrics

- Clastic Deformation Bands
- Grain Boundaries and Contacts
- Intragranular Structures
- Veins
- Pseudotachylyte
- Folds
- Faults and Shear Zones
- Extinction Microstructures
- Fractures
- Notes
- Associated Files
- Links

See Section 6.2.

Spatial Annotation with Spots

Users can add spatial annotations called *spots* directly onto images. Spots may be defined as points, lines, or polygons, each capable of storing customized observational data. This supports rigorous documentation of spatially resolved geological features. Quick Spot Presets apply saved combinations of data in one step, and auto spot mode places and names many spots quickly without a dialog for each one.

Project Management and Data Sharing

StraboMicro is designed to support the whole life of a research project:

- As new samples and observations are added, projects evolve in an organized and traceable manner.
- Every save creates a version on your computer, so you can go back to an earlier state of your project (Section 3.5).
- Projects can be synced with StraboSpot.org, used on several computers, and shared with collaborators who see each other's changes within seconds (Section 9).
- Projects can be made public on StraboSpot.org, so that others can view and search the data.
- A Digital Object Identifier (DOI) can be obtained for a project, for citation and long-term archiving (Section 3.11).

1.3 What's New in StraboMicro 2

StraboMicro 2 brings many new features and improvements over the original application. The major highlights:

Sync and Collaboration

- **Sync with StraboSpot:** keep a project on StraboSpot and on your computer; changes go up about a second after you make them, and arrive on your other computers by themselves.
- **Collaboration:** invite colleagues as Editors, Contributors or Viewers, see who is working where, and talk in the project's chat window.
- **Activity:** see who changed what, and restore deleted items.

Never Lose Your Work

- **Version History:** every save, including the automatic save every few minutes, creates a version you can restore.
- **Application Updates:** StraboMicro tells you when a new version is available and installs it when you choose.

Faster Annotation

- **Auto Spot Mode:** place many spots without a dialog; each is named and numbered for you.
- **Place Automatically on Parent:** StraboMicro finds where an associated micrograph sits on its parent by matching features in both images, works out its scale, and shows it in place for you to check. A whole batch of imported micrographs can be placed at once (Sections 5.4.4 and 5.7).
- **Finish Importing:** complete a batch of imported micrographs in one place: rotation, instrument information once for all, an image type per micrograph, and how to place them.
- **Placing Several Micrographs Together:** give a stack of images, such as element maps, the full area of their parent or the placement of one already placed; copy a scale from any micrograph in the project.
- **Quick Spot Presets:** save commonly used spot data, including tags, and apply it in one step.
- **Tags and Groups in the Metadata Pane:** tag a spot, or put a micrograph in groups, from **Add Data**, and see them in the pane (Section 4.7.1).
- **Quick Edit:** classify hundreds of spots from the keyboard.
- **Merge and Split:** combine polygon spots, or split one with a line.

- **Micrograph Visibility and Parent Spots:** step through a stack of micrographs one at a time, and see the spots of the micrographs above the one you are viewing.
- **Sketch Overlay:** freeform drawing layers with pen, marker and text, for markup and teaching.

AI-Powered Tools

- **Grain Spot:** click a grain and its outline is saved as a polygon spot, so you no longer trace grains corner by corner. The model runs on your computer, and no image leaves it (Section 5.15).
- **FastSAM Grain Detection:** an AI model outlines the grains in a micrograph and turns them into polygon spots. A classical OpenCV method is also available.

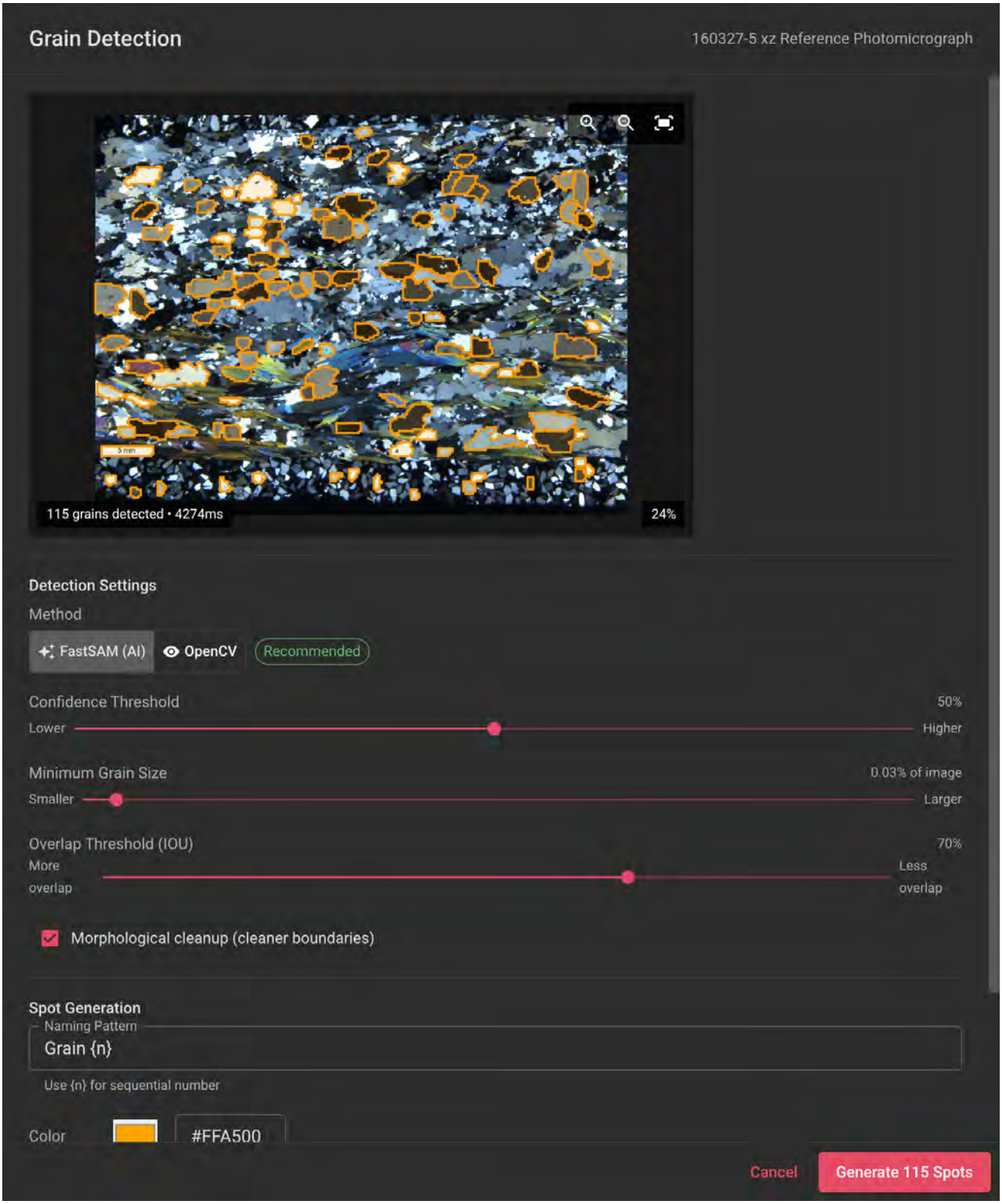


Figure 3. AI-powered grain detection using FastSAM automatically identifies and outlines grains in micrographs

Analysis Features

- **PPL/XPL Pairs:** link plane- and cross-polarized images of the same area and switch between them with the X key, keeping your view.

- **Point Counting:** modal analysis on regular or random grids, with confidence intervals.
- **Grain Size Analysis:** size and shape statistics with histogram and rose diagram.
- **StraboTools:** Edge Fabric, Color Index, Edge Detect and Mode analyses.
- **3-Point Registration:** place associated micrographs precisely by matching three or more points.
- **Image Stitcher:** join overlapping images of one area into a single mosaic, check and correct the fit, and add it as one micrograph, with the original images kept in place on it if you wish (Section 7.7).
- **Custom User Data:** attach your own spreadsheet columns (analysis numbers, mineral chemistry, ages) to spots, then view them in tables and download them again (Section 7.9).

Export and Sharing

- **Image Export:** export micrographs as JPEG, PNG or SVG, with or without overlays, spots, labels and sketches. SVG keeps annotations as editable vectors.
- **PDF Reports:** a complete project report with images and metadata.

1.4 System Requirements

StraboMicro runs on:

- **macOS** 13 (Ventura) or newer, on Apple Silicon or Intel Macs.
- **Windows** 10 or 11 (64-bit).
- **Linux** (64-bit), as an AppImage or a Debian/Ubuntu package.

There are no other specific hardware requirements. More memory helps with very large micrographs, and StraboMicro's tiled, level-of-detail rendering keeps it responsive on modest hardware. An internet connection is needed only for StraboSpot features (logging in, sync and collaboration, chat, opening remote or shared projects, linking StraboSamples, the instrument database) and for updates.

1.5 Getting Help and Support

To get started with StraboMicro and to deepen your understanding of its features, we recommend the following resources, all linked from `https://strabospot.org/help`:

- **Videos:** the *StraboMicro Basics* video playlist on YouTube gives step-by-step guidance.
- **User Manual:** this manual, also opened from `Help > StraboMicro User Guide`.
- **Office Hours:** one-on-one help sessions by appointment over Zoom. Book a time at `https://strabospot.org/help`.
- **Email Support:** contact us at StraboSpot@gmail.com.

- **Error Reports:** if something goes wrong in the application, use `Help > Send Error Report...` (Section 10.1).

2 Installation and Setup

2.1 Creating a StraboSpot Account

StraboMicro works without an account for projects kept on your computer. A free StraboSpot account is needed to sync projects, collaborate, link StraboSamples, and publish projects on StraboSpot.org. To register:

1. Open your web browser and go to `https://www.strabospot.org`.
2. Open the `Account` menu at the top right and choose `Register`. (In StraboMicro, the **Create account** link in the sign-in dialog opens the same page.)
3. Fill in the **Register for Account** form: First Name, Last Name, Email, Password and Confirm Password. Please use a real email address; it is used to verify your account and to sign in.
4. Click **Submit**. StraboSpot sends a confirmation email ("Confirm your StraboSpot account").
5. Open the email and click **Confirm my account** to activate your account.

Note: If you do not receive the confirmation email within a few minutes, check your spam or junk folder. If the issue persists, contact support at StraboSpot@gmail.com.

2.2 Downloading the Application

1. Go to `https://www.strabospot.org` and click `StraboMicro` in the top menu.
2. On the StraboMicro page, click **Download Now**. No login is needed.
3. The download page lists the current version for each system and marks the one for your computer with "Recommended for your system":
   - **Windows:** `StraboMicro2-Setup-`*`version`*`.exe`
   - **macOS (Apple Silicon):** `StraboMicro2-`*`version`*`-arm64.dmg`
   - **macOS (Intel):** `StraboMicro2-`*`version`*`.dmg`
   - **Linux (AppImage):** `StraboMicro2-`*`version`*`.AppImage`
   - **Linux (Debian/Ubuntu):** `strabomicro2_`*`version`*`_amd64.deb`

Note for macOS users: To see which Mac you have, choose `About This Mac` from the Apple menu. "Chip: Apple M1" (M2, M3, M4, ...) means Apple Silicon; "Processor: Intel" means Intel.

2.3 Installing on Windows/macOS/Linux

Windows:

- Double-click the downloaded `.exe` installer. The installer is signed by its publisher (Jason Ash).
- Follow the steps of the installer. You can choose the installation folder.

- Start StraboMicro from the Start menu or the desktop shortcut.

macOS:

- Open the downloaded `.dmg` file.
- Drag StraboMicro2 onto the `Applications` folder (Figure 4).
- Start the app from the Applications folder or Launchpad. The app is notarized by Apple, so macOS opens it normally.

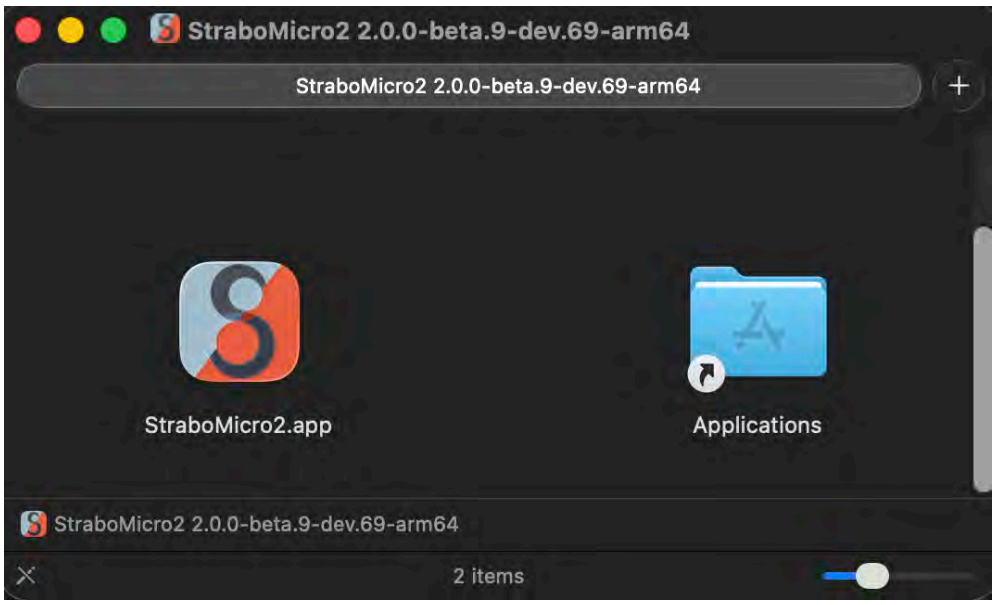


Figure 4. Drag StraboMicro2 to the Applications folder on macOS.

Linux (AppImage):

- The AppImage runs on most Linux distributions without installation.
- Make the file executable and start it:

```
chmod +x StraboMicro2-*.AppImage
./StraboMicro2-*.AppImage --no-sandbox
```

- Optionally, move the AppImage to a convenient location such as `~/Applications`.

Linux (Debian/Ubuntu package):

- Install the package (or double-click it to open it in your software installer):

```
sudo dpkg -i strabomicro2_*.deb
```

- Start StraboMicro from your applications menu.

2.4 First-Time Setup

When you start StraboMicro for the first time (Figure 5):

- The window opens with no project: “No project loaded. Create or open a new project to get started.” Create a project with `File > New Project` (Section 3.1) or open one (Section 3.2).
- StraboMicro creates a data folder named `StraboMicro2Data` in your Documents folder. Each project is a folder inside it.
- Application settings, the image tile cache and the version history are stored in the application’s settings folder:
  - **macOS:** `~/Library/Application Support/strabomicro2`
  - **Windows:** `%APPDATA%\strabomicro2`
  - **Linux:** `~/.config/strabomicro2`
- From time to time a **Message from StraboSpot** may appear with news about StraboMicro. Check **Don’t show this again** to hide that message.



Figure 5. StraboMicro at first launch.

2.5 Signing In

Choose `Account > Login...` (or click **Not logged in** at the top right of the window). In **Sign in to StraboSpot**, enter your Email and Password and click **Sign In**. The dialog also has **Create account** and **Forgot password?** links.

When you are signed in, your name appears at the top right; hold the pointer over it to see your email. “· offline” after your name means StraboMicro cannot reach StraboSpot at the moment. To sign out, click your name, or choose `Account > Logout`. If a synced project has changes that have not been sent yet, StraboMicro offers to sync them first.

You stay signed in between sessions. A login lasts 30 days from the last time you used StraboMicro, so as long as you use it at least once a month you do not have to sign in again (Section 9.2.4 explains what happens when a login runs out).

2.6 Preferences

`File > Preferences...` (`Cmd+,` on macOS, `Ctrl+,` on Windows/Linux) has three settings:

- **REST Server > Server URL:** the StraboSpot server address. Leave the default (`https://strabospot.org`) unless the StraboSpot team asks you to change it; the reset button restores it. Changing the server signs you out.
- **Sync > Sync new projects to StraboSpot when I'm logged in:** the choice New Project selects for you under "Where to keep this project" (Section 3.1).
- **Chat > Chat notifications:** show a notification when someone writes in the chat of the open project while StraboMicro is in the background (Section 9).

2.7 Updates

StraboMicro checks for a new version shortly after it starts and then every four hours. When one is available:

1. A message "Version *x* is available" appears at the bottom of the window. Click **Download**. The download continues in the background while you work.
2. When it is done, **Update Ready to Install** offers **Restart Now** or **Later**. With **Later**, the update is installed the next time you quit StraboMicro.

If a new version needs a newer operating system than yours (for example macOS 13), StraboMicro tells you so and keeps working on your current version.

2.7.1 Checking for Updates Manually

Choose `Help > Check for Updates...`. StraboMicro tells you whether an update is available.

2.7.2 Checking Your StraboMicro Version

Choose `Help > About StraboMicro`. The version number is shown in the dialog (Figure 6).

2.8 StraboMicro Instrument Repository

The **StraboMicro Instrument Repository** lets laboratories and research groups record their instruments once, so that users do not have to type instrument details for every micrograph. It stores:

- Instrument name, type, brand and model
- Institution and laboratory
- Data collection and post-processing software
- Detectors
- Notes



Figure 6. The About StraboMicro dialog showing version information.

When you add a micrograph, click **Find Instrument in Database** in the instrument step to choose an instrument from the repository; its details are filled in for you (Section 5.3.3). Anyone can browse the repository at `https://strabospot.org/instrumentcatalog` (StraboMicro page > **Instrument Repository**).

2.8.1 Adding Your Institution and Instruments

Institutions are added by the StraboSpot team, and each institution has one or more Principal Investigators (PIs) who manage its instruments.

1. To request a new institution, click **Need your instrument added to the database? Click here.** at the top of the **Find Instrument in Database** dialog (Figure 7). This starts an email to `strabospot@gmail.com`:

   ```
   Hello,

   Please add the following institute to the StraboMicro Apparatus
   Repository:

   Lab or Facility Name:
   Institute Name:

   StraboSpot Account: *your account email address*

   Thanks,

   *your account name*
   ```

   Fill in the Lab or Facility Name and Institute Name and send it. The repository page on the website has a similar link. You can also email the team directly to ask to become the PI of an existing institution (Section 1.5).

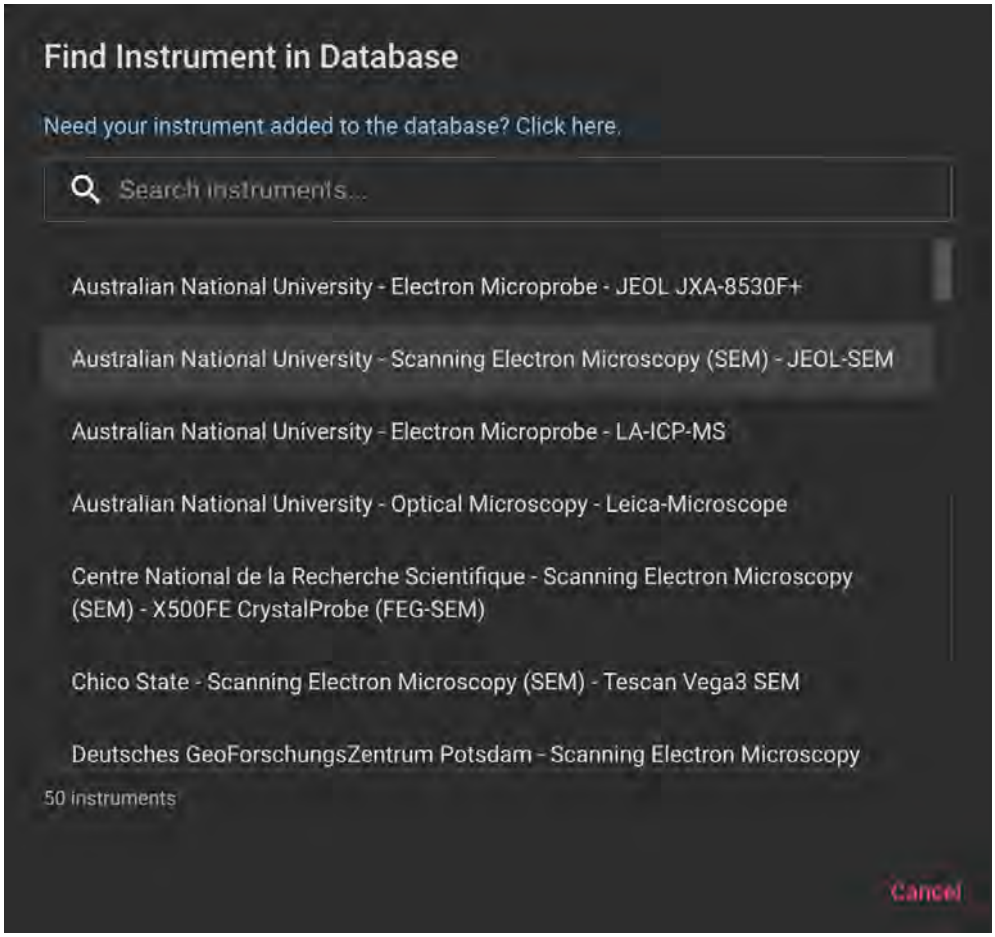


Figure 7. The **Find Instrument in Database** dialog.

2.8.2 Managing Instruments

Once you are a PI, sign in at `https://strabospot.org` and open the Instrument Repository (StraboMicro page > **Instrument Repository**). For your institution you can:

1. Add instruments with **+ Add Instrument**.
2. Edit or delete your institution's instruments.

Everyone can **View** any instrument's details.

3 Manage StraboMicro Projects

StraboMicro projects differ slightly in structure from other StraboSpot applications. In StraboMicro, each **Project** contains one or more **Datasets**, each dataset contains **Samples**, and each sample contains its micrographs and their spots. Each project is kept as a folder in the `StraboMicro2Data` folder in your Documents folder. A project can stay on your computer only, or be synced with StraboSpot.org for backup, use on other computers, and collaboration (Section 9).

To create a new project, choose `File > New Project` (`Cmd+N` / `Ctrl+N`). For installation details, see Section 2.

3.1 New Project

The **New Project** dialog includes the following fields:

- **Project Name***
- Start Date
- End Date
- Purpose of Study
- Other Team Members
- Area of Interest
- GPS Datum (default: WGS84)
- Magnetic Declination
- Notes
- **Where to keep this project***:
  - **On this computer only**
  - **On this computer and synced to StraboSpot (backup, use on other computers, share with collaborators)**. This choice needs you to be signed in.

  The choice is preselected by `File > Preferences... > Sync new projects to StraboSpot when I'm logged in`. You can turn sync on later for a project kept on this computer only (Section 9.1).

Required.* Click **Create Project. The new project appears in the **Samples** tab of the Project Navigation Pane.

Next, add a dataset and your first sample:

1. Click the **+** button next to the project name and choose **Add New Dataset**. Enter a **Dataset Name** and click **Create Dataset**.
2. Click the **+** button next to the dataset and choose **Add New Sample**. This opens the **New Sample** dialog (see Section 5.1).

3.1.1 Starting From Samples Collected in StraboField

Samples collected in StraboField are brought into StraboMicro through **StraboSamples**, the shared sample records on StraboSpot.org (see Section 5.2). Upload the StraboField project first, so its samples are on the server.

1. Create a project and dataset as described above.
2. Sign in to your StraboSpot account (`Account > Login...`).
3. Click the **+** button next to the dataset and choose **Add New Sample**.
4. In the **New Sample** modal, click **Link Sample From StraboSamples** and choose the sample from the list (see Section 5.2.1).

The sample's metadata is filled in from the StraboField sample: Sample ID, IGSN, location (latitude and longitude), Main Sampling Purpose, Sample Description, Material Type and Sample Notes. These fields stay managed by StraboField (see Section 5.2.3). Repeat for each sample you want to add from the same project.

3.2 Open Existing Projects

StraboMicro opens projects from a .smz file, from your StraboSpot account, or from a share code. StraboMicro shows one project at a time; opening another project closes the current one (it is saved first).

3.2.1 Open a Local Project (.smz)

1. Choose `File > Open Local Project (.smz)` (`Cmd+O` / `Ctrl+O`), or double-click a `.smz` file.
2. Select the file. StraboMicro shows the project's name and contents.
3. Click **Open Project**. The project is copied into your `StraboMicro2Data` folder; the .smz file itself is not changed.

If you already have this project on your computer, StraboMicro warns that opening the file replaces it, and offers **Import as a Separate Copy** instead: the file is opened as a new project named "*name* (copy)", with its own identity, and nothing on your computer or on StraboSpot is replaced. A .smz never replaces a synced copy of the same project; it can only be opened as a separate copy.

If the file has no image for some of its micrographs, StraboMicro says so before you open it ("This file is missing images"), so you can ask whoever made the file for a copy exported with its images. When the file replaces a project on your computer, your computer's images of those micrographs are kept.

3.2.2 Open a Remote Project

`File > Open Remote Project...` lists the projects in your StraboSpot account, including projects shared with you, and opens or downloads them. See Section 9.3.

3.2.3 Open a Shared Project

Someone who uploaded a project can give you its six-character share code (Section 3.10.2).

1. Sign in (`Account > Login...`).
2. Choose `File > Open Shared Project...`.
3. Enter the **Share Code** and click **Download**.
4. Click **Open Project**.

The shared project becomes your own independent copy: your changes do not affect the original, and the owner's later changes do not reach your copy. Each share code makes its own copy. Opening the same code again offers to replace the copy you made from it before. To work on a project together, use collaboration instead (Section 9.5).

3.3 Recent Projects Menu

Navigation: `File > Recent Projects`

The Recent Projects submenu lists up to **10 recently opened projects**, most recent first. Each entry shows:

- **Project name**
- When the project was last opened: "Today", "Yesterday", or the date (for example "Nov 25")
- When you are signed out, the account a synced copy belongs to
- A **checkmark** next to the project that is open

Choose a project to switch to it. If the current project is kept on this computer only and has unsaved changes, StraboMicro asks whether to save them first; synced projects are saved without asking. **Clear Recent Projects** removes entries of projects that no longer exist on this computer.

3.4 Saving Projects

Projects are saved in their folder in `~/Documents/StraboMicro2Data/` (synced projects in `StraboMicro2Data/accounts/`). There is no separate project file to keep track of; to make a copy of a project as a single file, use `File > Export as .smz...` (Section 3.7.1).

- **Save by hand:** `File > Save Project` (`Cmd+S` / `Ctrl+S`).
- **Automatic save:** StraboMicro saves the project five minutes after your last change, so recent work is kept even if you step away.
- **When you leave a project:** quitting StraboMicro or closing its window saves the project. Switching to another project saves it too (for a project kept on this computer only, StraboMicro asks first).
- **Synced projects** are also saved each time their changes are sent to StraboSpot.

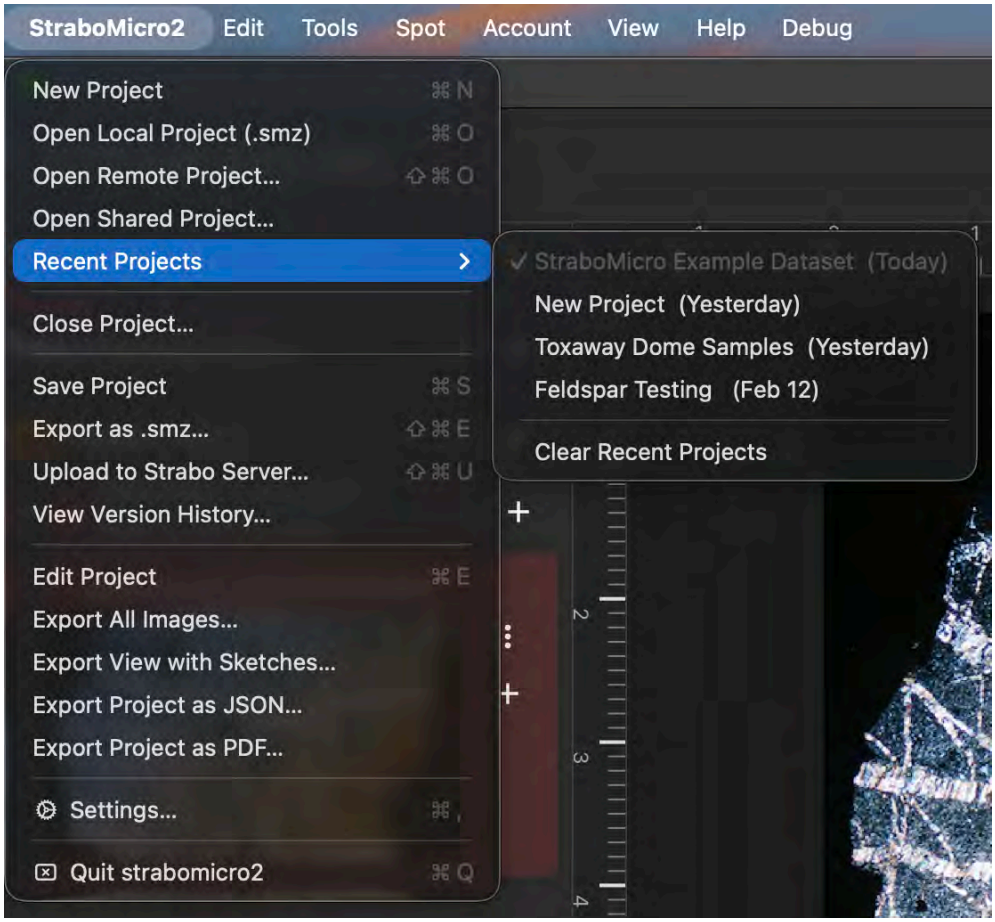


Figure 8. The Recent Projects menu with the open project checked.

Every save also creates a version in the version history.

3.5 Version History

StraboMicro keeps earlier versions of your project on your computer, so you can review what changed and go back to an earlier state.

3.5.1 Opening Version History

Navigation: `File > View Version History...`

The **Version History** dialog lists the saved versions, newest first.

3.5.2 Versions

Every save (by hand or automatic) creates a version. Each version shows its number, date and time, and either “Auto-save” or, for a named version, its name. Select a version to see its details (size, number of items changed) and its changes: what was added, removed and modified compared with the version before it (“Changes (v*N* → v*M*)”).

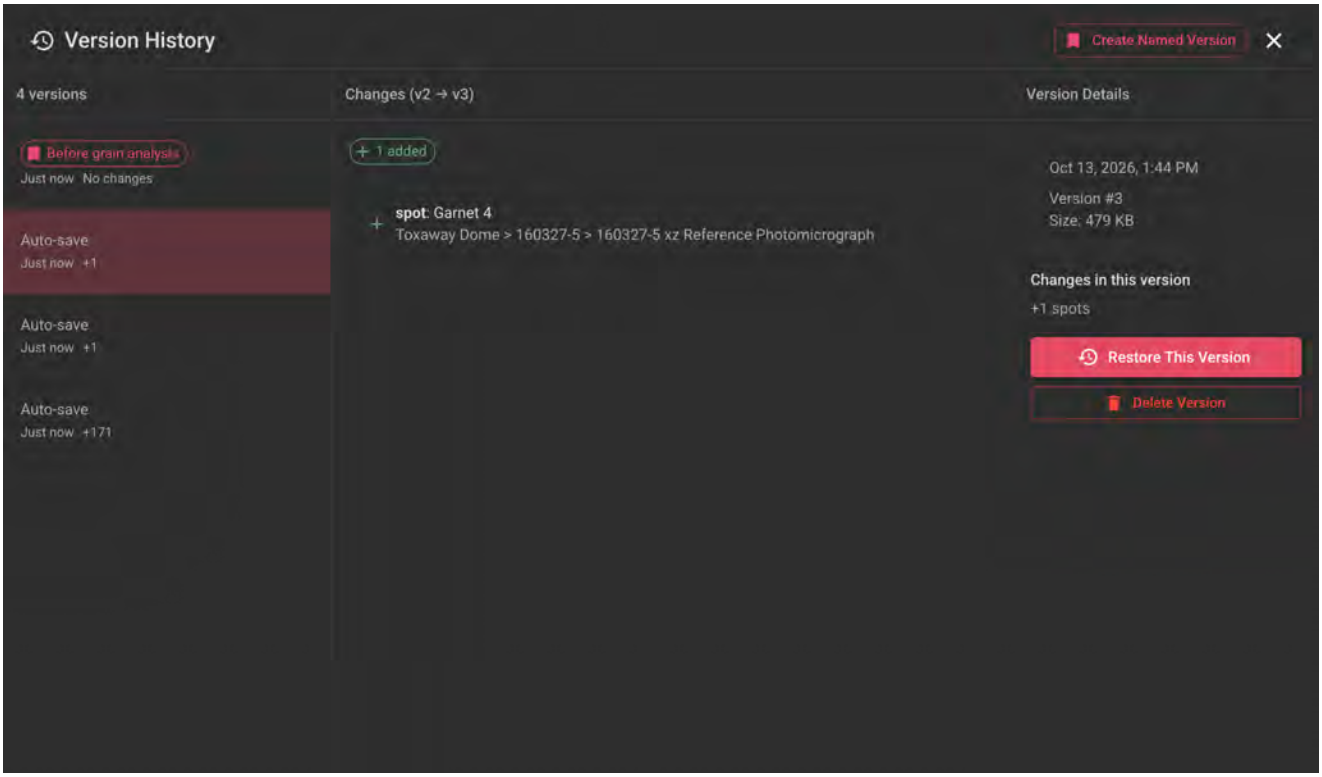


Figure 9. The Version History dialog: the list of versions, and the changes in the selected version with added (green), removed (red) and modified (orange) items.

3.5.3 Named Versions

Name a version to mark a milestone, such as “Before grain analysis”. Named versions are marked with a bookmark and are never removed automatically.

1. In the Version History dialog, click **Create Named Version**.
2. Enter a **Version Name** and, if you like, a **Description (optional)**.
3. Click **Create**.

3.5.4 Restoring a Version

1. Open `File > View Version History...` and select the version.
2. Review its changes.
3. Click **Restore This Version** and confirm with **Restore**.

Important: Before restoring, StraboMicro saves your current state as a version named “Before restore”, so you can return to it. In a synced project, the restored state is synced like any other change.

3.5.5 Removing Old Versions

StraboMicro keeps up to 200 versions per project. Unnamed versions older than 30 days may be removed, but the 10 most recent versions are always kept, and named versions are never removed automatically. You can also delete a version yourself with **Delete Version**.

Note: Version history is kept on this computer only. It is not included in .smz exports and is not synced; StraboSpot keeps its own history of synced projects (Section 9.8).

3.6 Closing a Project

`File > Close Project...` removes the project from your computer. Use it only for a project you no longer need here; to work on another project, simply open it or use `File > Recent Projects`.

- **A project kept on this computer only: Close & Delete Project** deletes the project files from your Documents folder, removes it from Recent Projects and clears its version history. This cannot be undone. Consider `Export as .smz...` or `Upload to Strabo Server...` first.
- **A synced project: Remove From This Computer** deletes this computer's copy only. The StraboSpot copy is not affected, and you can download it again with `File > Open Remote Project...`. If some changes have not been sent yet, the dialog says so; use `File > Sync to Strabo Server...` first to keep them.

3.7 Exporting Projects

3.7.1 Export as .smz

`File > Export as .smz...` (`Cmd+Shift+E` / `Ctrl+Shift+E`) saves the whole project as one `.smz` file: its data, images, image tiles, associated files, point counts and a PDF report. Use it for backups, to send a project by other means, or to open it in another copy of StraboMicro. See Appendix 11.3 for the contents.

If some micrographs have no image file on this computer, the dialog names them first ("1 micrograph has no image file on this computer"): the .smz would not have their images. Click **Cancel** and export from a copy of the project that still has them, or **Export Anyway**.

3.7.2 Export Project as PDF

`File > Export Project as PDF...` creates a report of the whole project. Choose where to save the file (default name *`project_report.pdf`*); the export starts right away. The report includes:

- A **table of contents** with clickable links, and a "Back to Table of Contents" link on each page.
- Every micrograph with its spots and labels (images up to 2000 pixels on the long side).
- All metadata for the project, samples, micrographs and spots, including each spot's Custom User Data (Section 7.9).

A project uploaded to StraboSpot also has a PDF report on the website (Section 3.10).

3.7.3 Export Project as JSON

`File > Export Project as JSON...` saves the project's data (`project.json`, without images) to a file you choose. JSON exports are useful for data analysis or for use in other tools.

3.8 Exporting Images

3.8.1 Export Images

`File > Export Images...` exports micrographs of the project as image files in one ZIP archive.

- **Micrographs: All**, or **Selected** with a tree of datasets, samples and micrographs to choose from (**All** / **None**).
- **Format:**
  - **JPEG:** smaller files.
  - **PNG:** lossless, supports transparency.
  - **SVG:** the micrograph as an image, with spots, labels and sketches as vector shapes that you can edit in vector graphics software (e.g., Adobe Illustrator, Inkscape). Ideal for publication figures.
- **Include: Micrograph image**, **Associated micrograph overlays**, **Spot shapes**, **Spot labels**, and **Visible sketch layers**.

Click **Export** and choose where to save the ZIP file (*`project_images.zip`*). It contains one file per micrograph, named after the micrograph, at the micrograph's full resolution. Your choices are remembered for the next export.

3.8.2 Export One Micrograph

To export the micrograph you are viewing, click the **Export Micrograph...** button at the top of the right panel. The **Export Micrograph** dialog has the same formats and options, and lets you choose individual sketch layers (**All** / **None**). Click **Export** and choose where to save the file.

Tip: To leave an associated micrograph out of an export, hide it with its eye button in the project tree before exporting.

3.9 Project Privacy

Projects uploaded to StraboSpot are private by default. To make a project public, sign in at `https://www.strabospot.org`, open the account menu (your name) and choose **My StraboMicro Data**. Each project has a **Public?** switch. When it is on (green), the project can be found by everyone in StraboSpot Search and has a public page. Switch it off to make the project private again.

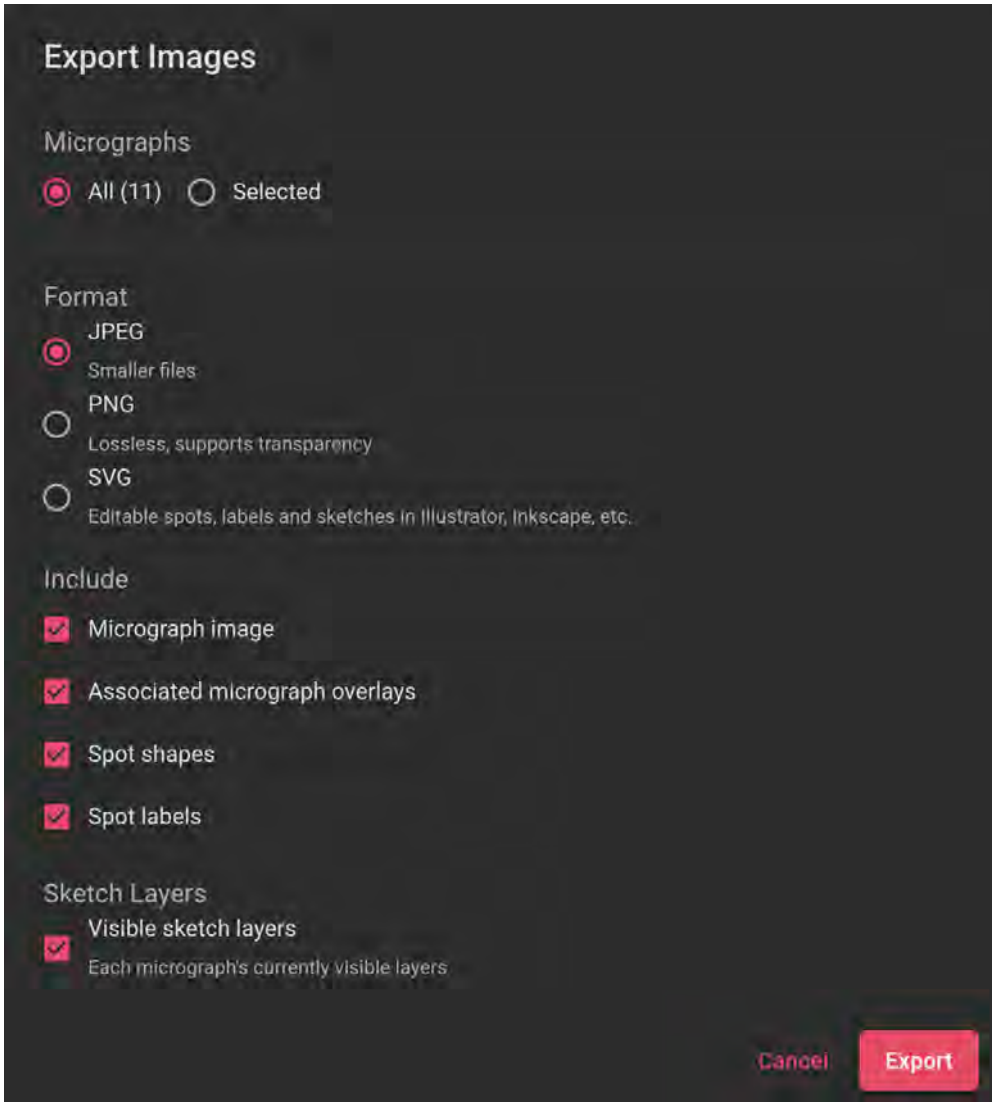


Figure 10. The Export Images dialog.

3.10 View and Share Projects on StraboSpot

3.10.1 My StraboMicro Data

Sign in at `https://strabospot.org` and choose **My StraboMicro Data** in the account menu. It lists the projects you own, with their upload or last-changed date and the **Public?** switch. Each project's **Options...** menu offers:

- **View:** opens the project in the StraboSpot web viewer, which has **PDF**, **SMZ** and **Share** buttons and an **Open in StraboMicro** button (Section 9.10).
- **Download:** the project as a .smz file.
- **Share:** the project's share code (below).
- **Collaborators** and **History** (synced projects; Section 9).
- **Get DOI** (Section 3.11).
- **Delete**.

Invitations to collaborate on other people's projects are listed at the top of the page, with **Accept**

and **Decline**.

3.10.2 Sharing a Copy with a Share Code

A share code lets anyone with a StraboSpot account download their own copy of your project in StraboMicro (`File > Open Shared Project...`). Choose **Options... > Share** for the project: the **Share StraboMicro Project** page shows its **Share Code** with a **Copy Link** button.

- The code always gives the project as it is on StraboSpot at that moment, not a fixed snapshot. For a fixed version, send a .smz export or create a DOI.
- Each person gets an independent copy; changes are not exchanged. To work on the same project together, invite them as collaborators instead (Section 9.5).

3.11 DOI Creation

A DOI (Digital Object Identifier) gives a fixed, citable version of your project that is not affected by later changes. StraboSpot prepares the files and a landing page; the DOI itself is issued by Zenodo.

3.11.1 Getting a DOI

1. In **My StraboMicro Data**, choose **Options... > Get DOI** for the project.
2. Click **Create DOI Files**. StraboSpot makes a snapshot of the project and its landing page.
3. Follow the instructions to upload the files to the StraboSpot community on Zenodo.
4. Paste the DOI that Zenodo gives you and click **Save**.

Your DOIs are listed under **My DOIs** in the account menu. The DOI leads to the project's landing page, which has **Download .SMZ** and **Download .PDF** links.

Tip: DOIs are ideal for citing your data in publications. Include the DOI in your manuscript's data availability statement so that reviewers and readers can access your project data.

4 User Interface Overview

The StraboMicro window has a header across the top and four panels: the project on the left, the micrograph in the center, its data on the right, and notes at the bottom. The side and bottom panels can be resized and hidden to suit your work.

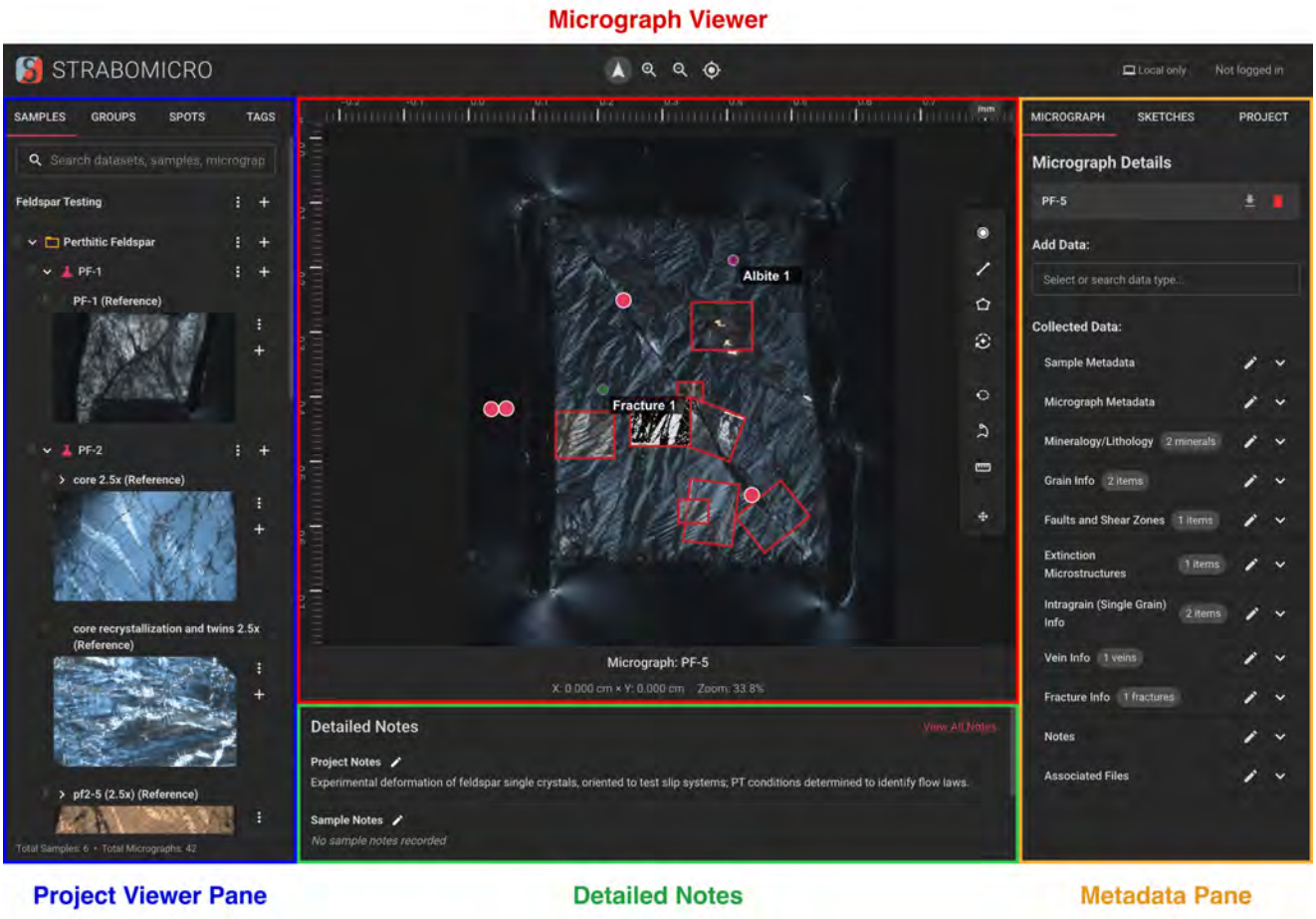


Figure 11. The StraboMicro window: Project Viewer Pane (left), Micrograph Viewer (center), Metadata Pane (right) and Detailed Notes (bottom).

- **Left Panel (Project Viewer):** Browse and select the samples and micrographs of the project. Tabs at the top organize it by **Samples**, **Groups**, **Spots** or **Tags**. A footer shows the total number of samples and micrographs.
- **Center Panel (Micrograph Viewer):** Shows the selected micrograph for viewing, annotation and analysis, with zoom up to 20x.
- **Right Panel (Metadata Pane):** The data of the selected micrograph or spot, with tabs for the **Micrograph** (or **Spot**), its **Sketches**, and the **Project**.
- **Bottom Panel (Detailed Notes):** All notes of the selected micrograph or spot in one place.
- **Header:** the navigation buttons, and on the right the status of collaboration and sync and your StraboSpot account (Section 4.3).
- **Menu Bar:** file management, editing, tools, spots, account, view options and help (Section 4.8).

4.1 Panel Flexibility

- **Resize:** drag the divider between two panels.
- **Hide and show:** click **Hide Panel** on a divider to hide that panel; click the **Show Panel** button at the window's edge to bring it back. StraboMicro remembers which panels are hidden.

4.2 StraboMicro Terminology

Understanding key terms used in StraboMicro will help users organize and interpret their image data effectively. Two important concepts in the platform are **Reference Micrographs** and **Associated Micrographs**.

Reference Micrograph

A **Reference Micrograph** is typically a low-resolution or stitched image (often a full thin section scan) that serves as a spatial framework for other, more detailed images. It provides context and scale for viewing and organizing high-resolution micrographs.

Associated Micrograph

An **Associated Micrograph** is any image placed on another micrograph, its parent. It is positioned and scaled on the parent, which relates high-magnification data (e.g., specific features, grains, or deformation structures) back to the broader context of the thin section.

There is no limit to the number of nested Associated Micrographs. Users can create hierarchical relationships among images at increasing levels of magnification or focus. This nested structure supports the documentation of geologic features from the thin section scale down to the grain or subgrain level.

Example Hierarchy

- **Reference:** Thin Section Scan
- **Associated:** Shear Zone Micrograph
- **Associated:** Specific Area within Shear Zone
- **Associated:** Image of Individual Grain
- **Associated:** EBSD Map of Grain

This hierarchical framework allows for the integration of multiple scales of observation, supporting detailed documentation and analysis within a consistent spatial context.

4.3 Header

- **Navigation (center): Pan and Select**, **Zoom In**, **Zoom Out** and **Re-Center Micrograph** (fits the whole micrograph in the viewer).

- **Collaboration and sync (right),** for synced projects:
  - small badges of the other people who have the project open right now;
  - the chat chip, which opens the project's chat window (Section 9.7);
  - the sync status chip, which shows what sync is doing and offers **Sync Now** and more (Section 9.2).

  For a project kept on this computer only, the sync chip offers to turn sync on.
- **Invitations:** a chip when someone has invited you to a project (Section 9.5).
- **Account:** your name when you are signed in, or **Not logged in** (Section 2.5).



Figure 12. The header of a shared project: navigation buttons, people who have the project open, the chat chip, the sync status chip and the account.

4.4 Project Viewer Pane: Project Navigation

The **Project Viewer Pane** is where you organize and open the content of the project: samples, micrographs, groups, spots and tags.

Navigation Tabs



Figure 13. Navigation tabs in the Project Viewer Pane.

- **Samples (default):** the hierarchy of datasets, samples, reference micrographs and associated micrographs, with thumbnails.
- **Groups:** micrographs gathered by theme, for example all micrographs showing chessboard extinction, or those containing garnet. See below.
- **Spots:** all spots of the project, listed by micrograph. Click a spot to open its micrograph with the spot selected.
- **Tags:** the project's tags and the spots assigned to each. Click a spot to open it. See below.

Searching the Project

A search box at the top of the Samples tab ("Search datasets, samples, micrographs…") filters the tree as you type. Matching items are highlighted and shown with the items above and below them. Clear the search with the **x** button or Esc.

Managing Samples and Micrographs

In the **Samples** tab, each row has a **three-dot menu** and a **+** button. Refer to Figure 14 for a labeled example.

Project:

- **Three-dot menu:** `Edit Project Metadata`
- **+ button:** `Add New Dataset`

Dataset:

- **Three-dot menu:** `Edit Dataset Metadata`, `Delete Dataset`
- **+ button:** `Add New Sample`

Sample:

- **Three-dot menu:** `Edit Sample Metadata`, `Delete Sample`
- **+ button:** `Add New Reference Micrograph`, `Batch Import Reference Micrographs`

Reference Micrograph:

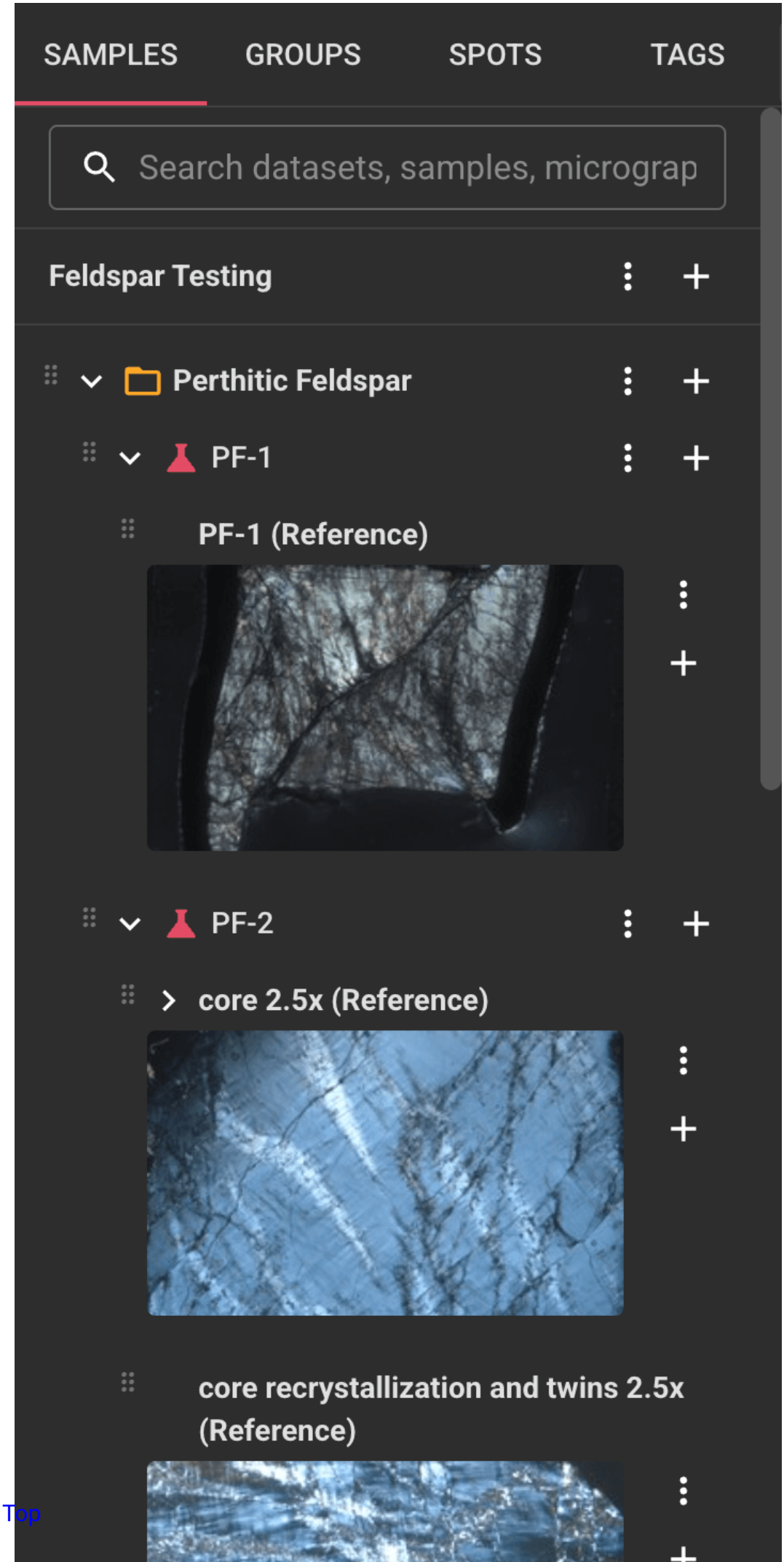
- **Three-dot menu:**
  - `Add to Group(s)`
  - `Edit Micrograph Metadata`
  - `Open in StraboTools` (Section 7.8)
  - `Delete Micrograph`
  - When some of its associated micrographs have no location: `Place children automatically...`, `Place unplaced children on its full area...`, `Place unplaced children like...`, `Delete unplaced children...` (Sections 5.7 and 5.8)
  - When it has associated micrographs: `Show All Associated Micrographs`, `Hide All Associated Micrographs`, `Edit All Associated Micrographs Opacity`
  - For PPL or XPL images: `Link Sibling PPL/XPL Image`, or `Unlink Sibling Image` for a linked pair (Section 5.11)
- **+ button:** `Add Associated Micrograph`, `Batch Import Associated Micrographs`, and for an unpaired PPL or XPL image `Add Corresponding XPL Image` (or `PPL`)

Associated Micrograph:

- **Three-dot menu:** the same items as a reference micrograph, plus `Edit Micrograph Location` and `Edit Micrograph Opacity`.
- **+ button:** the same items as a reference micrograph.
- The **eye button** shows or hides the associated micrograph (and its spots) on its parent. This is your own view: in a synced project, your collaborators keep theirs. To go through many at once, see Section 5.10.

A micrograph that still needs its instrument information, scale or location shows a warning dot on its thumbnail, with a tooltip saying what is missing. Click it to complete the missing information in Finish Importing (Section 5.6). Until it is complete, its three-dot menu has only `Delete Micrograph`.

In a shared project, items you are not allowed to use with your role are disabled (Section 9.5.3).


SAMPLES
GROUPS
SPOTS
TAGS
Search datasets, samples, micrograp
Feldspar Testing
Perthitic Feldspar
PF-1
PF-1 (Reference)
PF-2
core 2.5x (Reference)
core recrystallization and twins 2.5x (Reference)

Reordering

- **Drag** a dataset, sample or micrograph by its handle to change its place among its siblings (items in the same dataset, sample or parent micrograph).
- Or click the row and press `Cmd+Up` / `Cmd+Down` (macOS) or `Ctrl+Up` / `Ctrl+Down` (Windows/Linux).

Groups

In the **Groups** tab, the **+** button offers **Create New Group** and **Add Micrographs to Group(s)**. Each group's menu has **Add Micrograph to This Group**, **Edit Group Name** and **Delete This Group**; each micrograph in a group can be opened, or removed with **Remove from This Group**. You can also add a micrograph to groups from its `Add to Group(s)` item in the Samples tab, or from **Groups** in its **Add Data** list (Section 4.7.1).

Tags

In the **Tags** tab, **Add Tag** creates a tag with a **Tag Name**, a **Tag Type** (Conceptual, Documentation, Rosetta, Experimental Apparatus, or other), a **Fill Color** and **Notes**. Each tag's menu has **Assign Spots**, **Edit Tag** and **Delete Tag**. Expand a tag to see its spots, and click a spot to open it. A single spot can also be tagged from **Tags** in its **Add Data** list (Section 4.7.1).

Project Totals

At the bottom of the Project Viewer Pane:

```
Total Samples: X • Total Micrographs: Y
```

4.5 Micrograph Viewer: Image Display

The **Micrograph Viewer** displays the micrograph selected in the Project Viewer Pane. It is the main workspace for viewing, analyzing and annotating images, with smooth panning and zooming of even very large images.

Navigating

- **Zoom:** scroll the mouse wheel or use a trackpad gesture; the zoom centers on the pointer. Or use **Zoom In** and **Zoom Out** in the header. Zoom goes up to 20x.
- **Pan:** drag the image. This also works while a spot tool is selected; a click without dragging places the spot.
- **Re-Center Micrograph** in the header fits the whole micrograph in the viewer.

Rulers, Coordinates and Zoom

Scale rulers run along the top and left edges of the image and adjust as you zoom and pan. Below the image, a status line shows the position of the pointer on the image and the zoom level, for example:

```
X: 3.012 mm × Y: 5.905 mm    Zoom: 150%
```

The unit (µm, mm or cm) is chosen automatically from the micrograph's scale. Under the image, the name of the micrograph or selected spot is shown (or the number of selected spots).

Associated Micrographs

Associated micrographs are drawn on top of their parent, outlined in red (`View > Show Overlay Outlines`). With Pan and Select active, click one to open it; a back button returns to the parent. StraboMicro chooses the resolution of each associated micrograph from the zoom level and how much of the screen it covers, so it stays sharp at any zoom without slowing the viewer down. Micrographs placed by an approximate point are shown as red circle markers.

Large Images

Large images are shown from tiles prepared when the micrograph is added. A reduced copy appears immediately, and full-resolution tiles fill in as you zoom. The tiles are kept in a cache on your computer for instant display later. If an image ever shows seams or missing areas, use `Tools > Rebuild Tile Cache...` (Section 7.11).

Detailed Notes

Beneath the image is the collapsible **Detailed Notes** panel. It shows the Project Notes, Sample Notes and Micrograph (or Spot) Notes, which you can edit in place with the pencil, followed by the notes of each kind of data entered for the micrograph or spot (polish, instrument, mineralogy, fabrics, and so on). **View All Notes** shows them all.

4.6 Drawing Toolbar

A floating toolbar on the Micrograph Viewer holds the tools for creating and managing spots. It is docked on the right by default; **Move Toolbar** moves it to the bottom, left or top. The buttons are:



Point Spot (P): for small, specific features such as individual grains, inclusions or analysis locations.



Line Spot (L): for linear features, transects or boundaries.



Polygon Spot (G): for areas such as grains, mineral zones or deformation domains.



Grain Spot (W): click a grain and its outline becomes a polygon spot (Section 5.15).



Auto spot mode: place and name spots without a dialog (Section 5.14).



Lasso Select (or `Shift+Drag`): draw around spots to select them.



Sketch Mode: freeform drawing layers (Section 8).



Measure Distance (`M`): measure on the micrograph in real units (µm, mm, cm) from its scale.



Move Toolbar: move the toolbar to another edge of the viewer.

The active tool is highlighted. Click it again, choose **Pan and Select** in the header, or press `V` to return to selecting and panning. The toolbar is hidden in sketch mode and during point counting.

Changing Spot Colors

To change the color and opacity of one spot, right-click it and choose `Edit Spot Metadata`, or click the pencil of its **Spot Metadata** section in the Metadata Pane. For several spots at once, select them (`Shift+Drag` or `Cmd+Click`) and choose `Spot > Edit Selected Spots...` (`Cmd+Shift+B`) or right-click and choose `Edit N Selected Spots...` (Section 5.17).

4.7 Metadata Pane Overview

The **Metadata Pane** displays the data of the selected micrograph or spot: what was entered when the micrograph was added, and everything entered since.

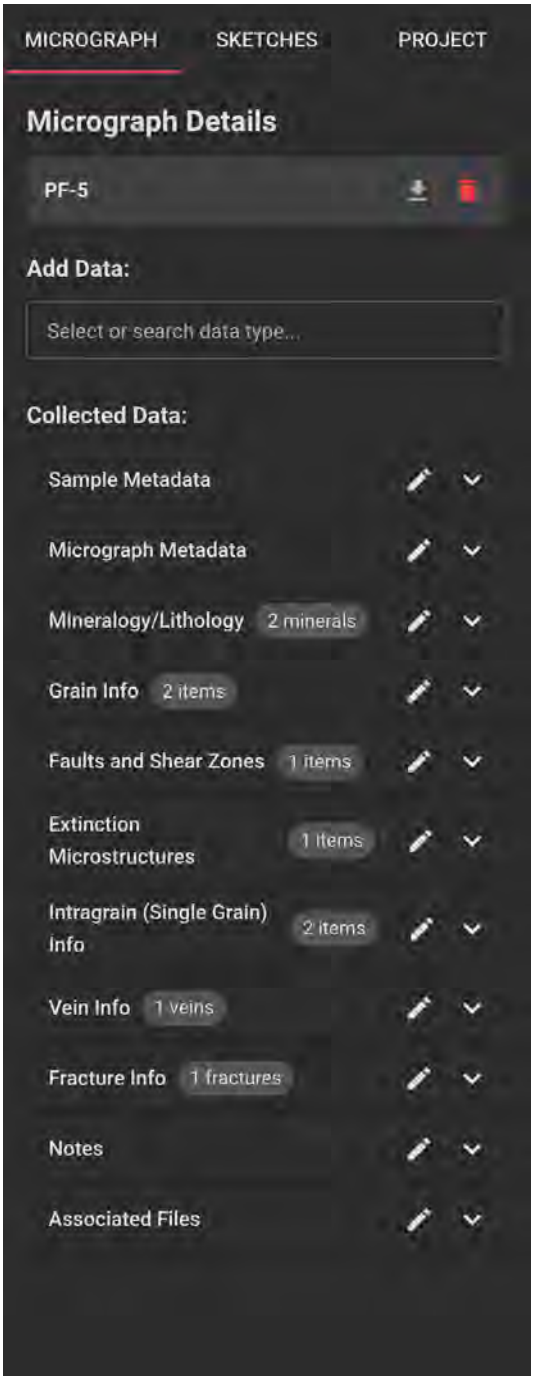


Figure 15. The Metadata Pane, with tabs for the selected Micrograph or Spot, its Sketches, and the Project.

Tabs

- **Micrograph** or **Spot**: whichever is selected. A selected spot shows the spot's data.
- **Sketches**: the sketch layers of the micrograph (shown when a micrograph, not a spot, is selected; Section 8.5).
- **Project**: the project's information.

Title Bar

At the top of the tab, **Micrograph Details** or **Spot Details** is followed by a bar with the name and two buttons: **Export Micrograph...** (Section 3.8) and **Delete Micrograph** (or **Delete Spot**).

4.7.1 Data Entry Section

Below the title, **Add Data:** has one field, "Select or search data type...". Click it to choose from the list, or type to search; the search also finds the fields inside each data type. For a spot, an **Apply Preset** button applies a Quick Spot Preset (Section 7.4).

The data types for a micrograph are listed below; for a spot, **Spot Data** replaces **Micrograph Info**. They are described in **Section 6: Data Entry and Observation Tools**.

- Sample Info
- Micrograph Info
- Mineralogy/Lithology
- Grain Size/Shape/SPO
- Fabrics
- Clastic Deformation Bands
- Grain Boundaries / Contacts
- Intragranular Structures
- Veins
- Pseudotachylyte
- Folds
- Faults and Shear Zones
- Extinction Microstructures
- Fractures
- Notes
- Associated Files
- Links

At the end of the list, a micrograph also has **Groups** and a spot has **Tags**:

- **Tags** (spot) opens **Tags of "*spot name*"**: check the project's tags the spot should have and click **Save**. New tags are made in the **Tags** tab of the left pane.
- **Groups** (micrograph) opens **Add "*micrograph name*" to Group(s)**, the same dialog as `Add to Group(s)` in the Samples tab.



Figure 16. Choosing a spot's tags from **Add Data > Tags**.

The data already entered is listed under **Collected Data**, one section per type, with a pencil to edit it. **Notes**, **Associated Files** and **Links** are always listed, even when empty, so you can add them with their pencil. Results of the analysis tools (Point Count Results, Grain Size Analysis, StraboTools) and imported Custom User Data (Section 7.9) also appear here. A spot with tags

has a **Tags** section (“1 tag”, “2 tags”) with the tags in their colors, and a micrograph in a group has a **Groups** section; their pencil opens the same dialogs. These two sections are shown only when there is something in them.

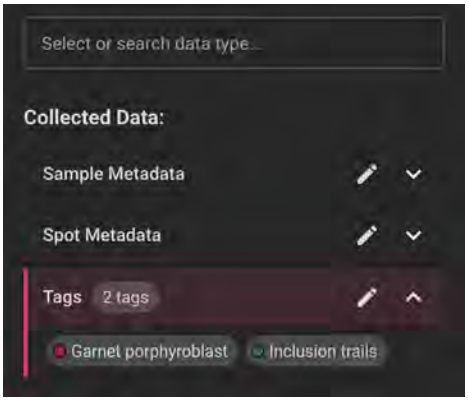


Figure 17. A spot’s **Tags** section under Collected Data.

4.8 Top Menu Overview

On macOS the first menu is named **StraboMicro2**; on Windows and Linux it is **File**. The other menus are **Edit**, **Tools**, **Spot**, **Account**, **View** and **Help**. Keyboard shortcuts are shown next to the menu items; on Windows and Linux use `Ctrl` where macOS uses `Cmd`.

File Menu (StraboMicro2 on macOS)

- **New Project** (`Cmd+N`): create a project (Section 3.1).
- **Open Local Project (.smz)** (`Cmd+O`): open a project from a .smz file.
- **Open Remote Project...**: open or download a project from your StraboSpot account (Section 9.3).
- **Open Shared Project...**: get your own copy of a project with a share code.
- **Recent Projects**: switch to a recently opened project.
- **Close Project...**: remove the project from this computer (Section 3.6). For a project kept on this computer only, this deletes it.
- **Save Project** (`Cmd+S`).
- **Export as .smz...** (`Cmd+Shift+E`).
- **Upload to Strabo Server...** (`Cmd+Shift+U`): turn on sync for the project; for a synced project this item is **Sync to Strabo Server...** and syncs now (Section 9).
- **Collaborate...**: the people you share the project with (Section 9.5).
- **View Version History...** (Section 3.5).
- **Edit Project** (`Cmd+E`): the project’s information.
- **Export Images...**, **Export Project as JSON...**, **Export Project as PDF...** (Section 3.7).
- **Preferences...** (`Cmd+,`) (Section 2.6).

- **Quit** (`Cmd+Q` on macOS; **Exit** on Windows).

Edit Menu

- **Undo** (`Cmd+Z`) and **Redo** (`Cmd+Shift+Z`): undo and redo changes to the project, such as adding, moving or deleting spots and editing data.
- **Cut**, **Copy**, **Paste**, **Select All**: for text fields.
- **Clear All Spots...**: delete all spots on the current micrograph.

Tools Menu

- **Point Count...** (Section 7.1)
- **Grain Detection...** (`Cmd+Shift+G`) (Section 7.2)
- **Image Comparator...** (Section 7.6)
- **Image Stitcher...** (Section 7.7)
- **Grain Size Analysis...** (`Cmd+Shift+A`) (Section 7.5)
- **StraboTools...** (`Cmd+Shift+T`) (Section 7.8)
- **Custom User Data...** (Section 7.9)
- **Rebuild Tile Cache...** (Section 7.11)

Spot Menu

- **Quick Spot Presets...** (`Cmd+Shift+P`): saved spot data, global or for this project (Section 7.4).
- **Quick Edit Spots...** (`Cmd+Shift+Q`): classify spots one at a time from the keyboard (Section 7.3).
- **Edit Selected Spots...** (`Cmd+Shift+B`): change the mineral, color or opacity of several spots at once.
- **Merge Selected Spots** (`Option+Cmd+M`): combine two or more polygon spots into one.
- **Split Spot with Line...** (`Cmd+/`): split a polygon spot in two with a drawn line.
- **Configure Mineral Colors...**: the colors used by View Spots by Mineral Color (Section 7.10).

Account Menu

- **Login...**: sign in to your StraboSpot account (Section 2.5).
- **Logout**.

View Menu

- **Show Rulers**: the scale rulers around the micrograph.

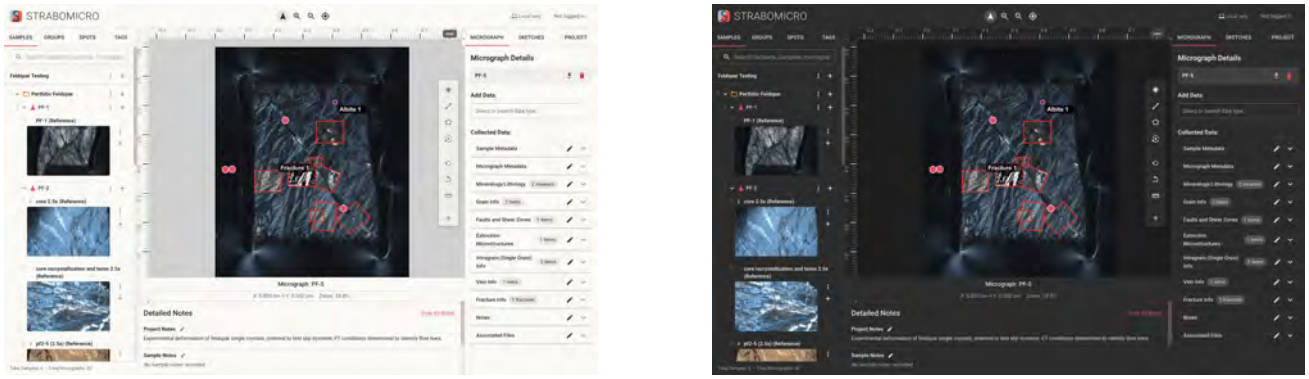
- Spot labels, one of: **Show Original Spot Labels** (spot names), **Show Mineralogy Spot Labels** (mineral abbreviations, for spots with mineralogy), **Hide Spot Labels**. **Cycle Spot Labels** (`Cmd+Shift+L`) steps through the three.
- **Show Overlay Outlines** (`Cmd+Shift+O`): red outlines around associated micrographs.
- **Show Recursive Spots** (`Cmd+Shift+R`): show the spots of associated micrographs on their parent (Section 5.19).
- **Show Parent Spots**: show the spots of the micrographs above the one you are viewing (Section 5.20).
- **Micrograph Visibility...** (`Cmd+Shift+V`): show, hide or fade the associated micrographs of the one you are viewing (Section 5.10).
- **View Spots by Spot Color** or **View Spots by Mineral Color**.
- **Filter Spots...** (`Cmd+Shift+F`): dim or hide spots by the data they have (Section 5.17.5).
- **Activity**: who changed what in a synced project (Section 9.8).
- **Theme**: **Dark**, **Light** or **System**.

Help Menu

- **About StraboMicro**: version and license.
- **StraboMicro User Guide**: opens this manual on StraboSpot.org.
- **Check for Updates...** (Section 2.7).
- **View Error Logs...**: shows the application logs, with **Copy to Clipboard** and **Email Support**.
- **Send Error Report...**: describe a problem and send it, with the logs, to the StraboMicro developers (Section 10.1).

4.9 Theme Support

StraboMicro has a dark theme (the default) and a light theme:



(a) Light Theme (b) Dark Theme

Figure 18. StraboMicro in the Light and Dark themes.

- **Dark:** a dark interface that is easy on the eyes and lets micrographs stand out.

- **Light:** a bright interface for well-lit rooms.
- **System:** follows your operating system's light or dark setting, and switches when it does.

Choose the theme with `View > Theme`. The change takes effect at once and is remembered.

4.10 Keyboard Shortcuts

Frequently used shortcuts:

Action	macOS	Windows/Linux
Save Project	`Cmd+S`	`Ctrl+S`
Undo	`Cmd+Z`	`Ctrl+Z`
Redo	`Cmd+Shift+Z`	`Ctrl+Shift+Z`
Pan and Select	`V`	`V`
Point / Line / Polygon Spot	`P` / `L` / `G`	`P` / `L` / `G`
Measure Distance	`M`	`M`
Lasso-select spots	`Shift+Drag`	`Shift+Drag`
Add a spot to the selection	`Cmd+Click`	`Ctrl+Click`
Switch PPL/XPL image	`X`	`X`
Edit Selected Spots	`Cmd+Shift+B`	`Ctrl+Shift+B`
Cycle Spot Labels	`Cmd+Shift+L`	`Ctrl+Shift+L`
Move tree item up / down	`Cmd+Up` / `Cmd+Down`	`Ctrl+Up` / `Ctrl+Down`

For the complete list, see **Appendix 11.2: Keyboard Shortcuts**.

5 Sample and Spot Management

This section covers creating samples, adding and placing micrographs, pairing PPL and XPL images, and creating and managing spots.

5.1 Add New Sample

To add a sample, click the **+** button next to the dataset and choose **Add New Sample** (see Section 4.4 and Figure 14).

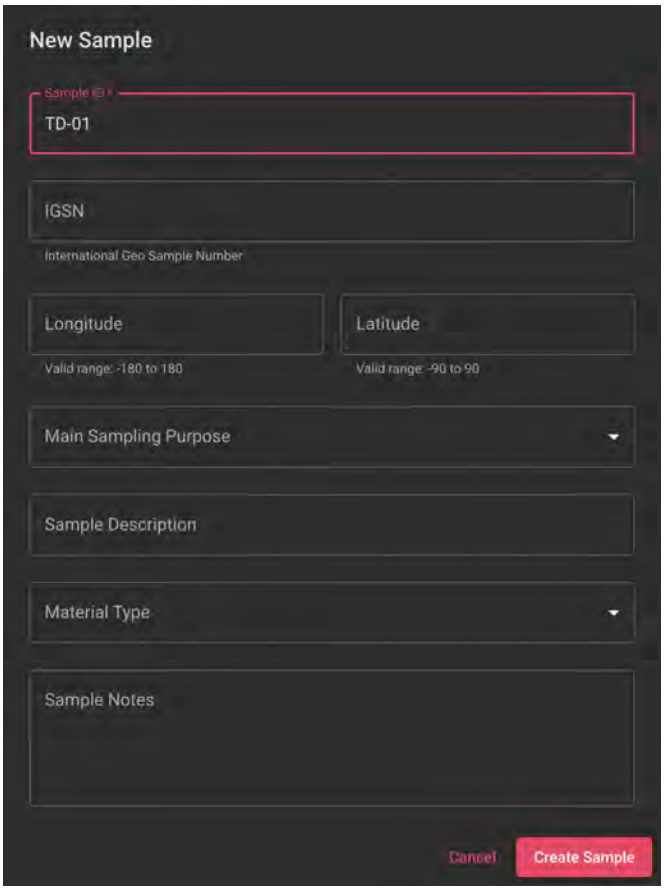


Figure 19. The New Sample dialog.

When you are signed in, the top of the dialog has a **Link Sample From StraboSamples** button for samples that already exist on StraboSpot.org, such as samples collected in StraboField (see Section 5.2.1).

The dialog collects descriptive metadata for your sample:

- **Sample ID***
- **IGSN:** International Generic Sample Number
- **Location:** Longitude and Latitude
- **Main Sampling Purpose:**
  - Fabric / Microstructure
  - Petrology

  - Geochronology
  - Geochemistry
  - Active Eruption
  - Other
- **Sample Description**
- **Material Type:**
  - Intact Rock
  - Fragmented Rock
  - Sediment
  - Tephra
  - Carbon or Animal
  - Other
- **Sample Notes**

Required.* Click **Create Sample to add the sample to the dataset.

5.2 StraboSamples: Shared Sample Records

StraboSamples is the part of the StraboSpot website that gives every physical sample one shared record, used by StraboField, StraboMicro and StraboExperimental. When a StraboMicro project is synced to StraboSpot (Section 9), each of its samples becomes a StraboSamples record (or joins an existing one), and the record lists every project that uses the sample. You can see all of your samples at `strabospot.org`, under `My Samples` in the account menu. See the *StraboSamples User Guide* for the full description of the website.

5.2.1 Linking a Sample to an Existing StraboSamples Record

If the sample already exists in StraboSamples (for example, it was collected and uploaded with StraboField, or created on the website), link to that record instead of typing the sample in again. Typing the same Sample ID does **not** link two samples; only linking does.

1. Sign in to your StraboSpot account in StraboMicro. The link button is only shown when you are signed in.
2. In the **New Sample** window, click **Link Sample From StraboSamples**.
3. The **Link Sample From StraboSamples** window lists your samples from StraboField, StraboMicro and StraboExperimental, with their material type, purpose and description. Type in the search box (`Search by name, IGSN, or description...`) to narrow the list.
4. Click a sample. The window closes, the sample's information is filled in, and **Linked to StraboSamples** is shown with the sample's identifier.
5. Complete the rest of the form and click **Create Sample**.

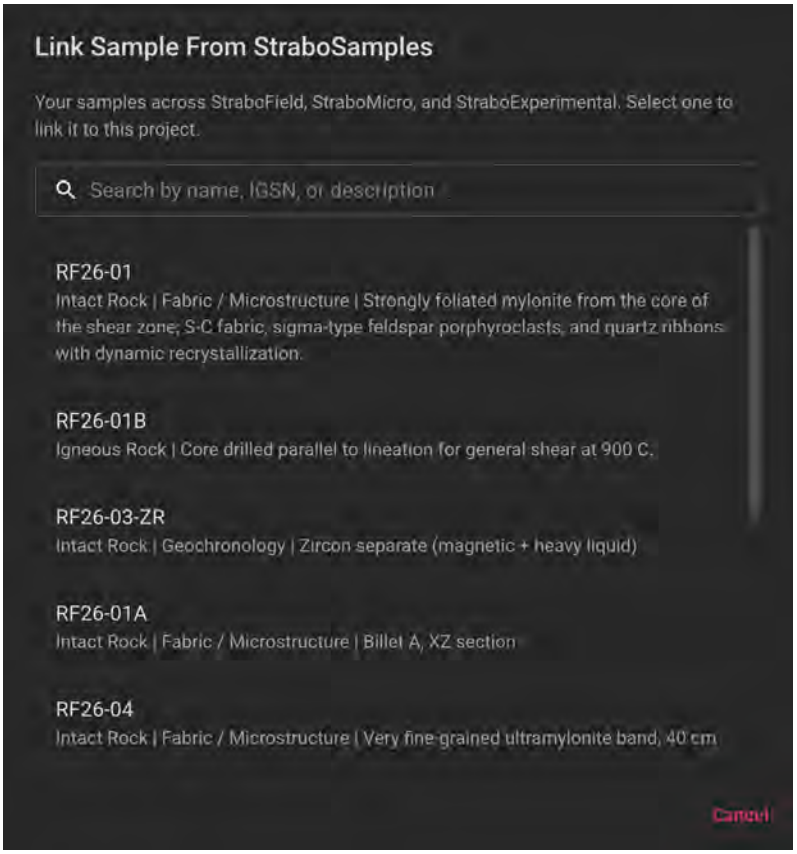


Figure 20. The Link Sample From StraboSamples window lists your samples from all StraboSpot applications.

In the list:

- Samples already in the current project are marked `(already linked)` and cannot be chosen again.
- Samples that another user has shared with you are grayed out. They cannot be linked from StraboMicro yet, because a synced project records samples under your own account.

The link takes effect on the server when the project is synced.

5.2.2 Linking, Changing or Unlinking an Existing Sample

Open **Edit Sample** for a sample in your project. When you are signed in, the top of the window shows the sample's StraboSamples status:

- **Linked to StraboSamples**: the sample is linked to a StraboSamples record.
- **In StraboSamples (View on Server)**: the sample has a StraboSamples record from an earlier sync or upload. Click it to open the sample's page on the website.
- Small labels show which applications use the sample (StraboField, StraboMicro, StraboExperimental).

The buttons below the status are:

- **Link Sample From StraboSamples** (or **Link to Different Sample** for a linked sample): choose a record as described above. The window shows **Will link to StraboSamples**



Figure 21. New Sample after linking a StraboField sample. The fields are filled in and locked, because the sample is managed by StraboField.

until you save.

- **Unlink from StraboSamples**: the window shows **Will unlink from StraboSamples**. When you save, the sample gets a new identifier and becomes a separate, independent sample. The StraboSamples record keeps its other links.

5.2.3 Samples Managed by StraboField

When a sample is linked to a sample that came from StraboField, StraboMicro shows: `This sample is managed by StraboField, so its core fields are locked here.` Edit those fields in StraboField or on the sample's page at strabospot.org; the changes reach the StraboMicro project automatically. The sample's location also comes from StraboField.

5.2.4 Edits Made on the Website

A sample's shared fields (Sample ID, IGSN, description, notes, location, material type and sampling purpose) can also be edited on the sample's page at strabospot.org, with **Edit Metadata**. Those edits appear when the project is viewed or downloaded from StraboSpot and in its project PDF, which is regenerated automatically. Clearing a field on the website does not clear it in StraboMicro.

Note: When a sample is used by both StraboField and StraboMicro, the StraboField values take priority for the shared fields. Syncing a StraboMicro project does not overwrite them.

5.3 Add a Reference Micrograph

Click the **+** button of the sample and choose:

- `Add New Reference Micrograph` to add one micrograph with the step-by-step dialog described below, or
- `Batch Import Reference Micrographs` to add several at once (Section 5.5).

The **New Reference Micrograph** dialog guides you through eight steps (nine for instruments that have an Instrument Settings step). The progress bar shows "Step *N* of *M*". Use **Back** and **Next** to move between steps; the last step has **Finish**.

5.3.1 Step 1: Load Reference Micrograph

Click **Browse...** and choose the image file (**Micrograph File**). Supported formats: TIFF, JPEG, PNG and BMP. Large TIFF files are converted for display, which can take a moment ("Converting Image..."). TIFFs with a color table (indexed color, as some EDS software saves element maps) keep their colors, and 16-bit TIFFs (such as BSE images) keep their brightness differences. Images imported with a version before 2.0.55 stay as they were imported; to get these improvements, delete them and import them again.

If the area was photographed as several overlapping images, click **Stitch Images...** instead of **Browse...**. The Image Stitcher joins them into one mosaic, which becomes the image of this micrograph (Section 7.7).

Note: Images narrower than 2000 pixels are enlarged to 2000 pixels wide, and images longer than 10,000 pixels on a side are reduced, to keep display fast and coordinates consistent with the original StraboMicro.

5.3.2 Step 2: Image Rotation

If the image is not the right way up, rotate it with **Rotate 90° counter-clockwise** or **Rotate 90° clockwise**, and mirror it with **Flip (mirror) the image left-right**. The resulting size in pixels is shown. The rotation and flip are applied to the image when it is added and cannot be changed afterwards.

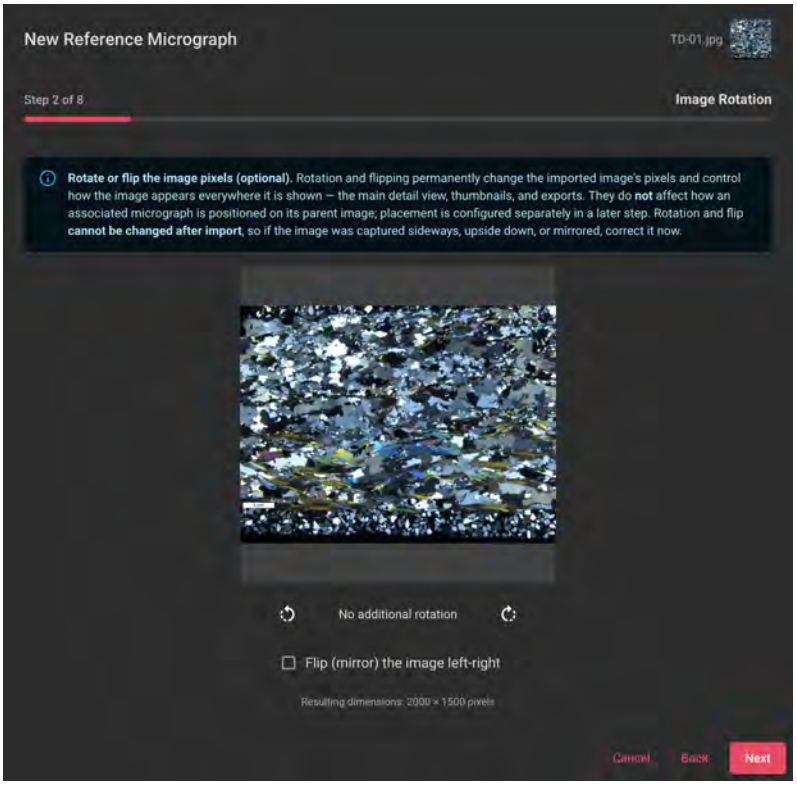


Figure 22. The Image Rotation step of the New Reference Micrograph dialog.

5.3.3 Step 3: Instrument & Image Information

- **Load Metadata from Previous Image:** copy the instrument information of a micrograph already in the project (shown when there is one).
- **Find Instrument in Database:** choose an instrument from the StraboMicro Instrument Repository; its details are filled in (Section 2.8).
- Or choose the **Instrument Type** yourself:
  - Optical Microscopy
  - Scanner
  - Transmission Electron Microscopy (TEM)
  - Scanning Transmission Electron Microscopy (STEM)
  - Scanning Electron Microscopy (SEM)
  - Electron Microprobe
  - Fourier Transform Infrared Spectroscopy (FTIR)
  - Raman Spectroscopy
  - Atomic Force Microscopy (AFM)
  - Other

Then choose the **Image Type**. For TEM, STEM, SEM and Electron Microprobe, first choose the **Data Type**, then the image type where one applies:

- **Optical Microscopy:** Plane Polarized Light, Cross Polarized Light, Reflected Light, 1/4 Lambda Plate, Cathodoluminescence, Gypsum Plate.
- **Scanner:** No Polarizer, Plane Polarized, Cross Polarized, Other.
- **TEM:** Bright Field, Dark Field, Electron Diffraction (SAED, CBED, NBD, LACBED), Energy Dispersive X-ray Spectroscopy (EDS), Automated Crystal Orientation Mapping (ACOM), Energy Dispersive X-ray Tomography.
- **STEM:** Bright Field, Dark Field, Annular Dark Field (ADF), High-Angle Annular Dark Field (HAADF), EDS, Electron Energy Loss Spectroscopy (EELS), Cathodoluminescence (CL: Panchromatic CL Image, Wavelength Filtered CL Image, Cathodoluminescence Spectroscopy).
- **SEM:** Secondary Electron (SE), Backscatter Electron (BSE), Forescatter Electron (FSE), Electron Backscatter Diffraction (EBSD: Orientation (Euler), Orientation (IPF-X, IPF-Y, IPF-Z), Band Contrast, Phase Map, Misorientation to Mean, Grain Boundaries, Sub-grain Boundaries), Transmission Kikuchi Diffraction (TKD), Electron Channeling Contrast Imaging (ECCI), EDS, Wavelength-dispersive X-ray spectroscopy (WDS), Cathodoluminescence (CL: Panchromatic CL Image, Wavelength Filtered CL Image), Focused Ion Beam SEM (FIB Imaging).
- **Electron Microprobe:** SE, BSE, ECCI, EDS, WDS, Cathodoluminescence (Panchromatic SEM-CL Image, Wavelength Filtered SEM-CL Image).
- **FTIR** and **Raman Spectroscopy:** False Color Map, Intensity Map.
- **AFM:** Topography Image.

For EDS and WDS, choose the elements on the periodic table. For a Plane or Cross Polarized image, a button offers to add the corresponding XPL (or PPL) image as a linked pair (Section 5.11). Abbreviations are explained in Appendix 11.1.

5.3.4 Step 4: Instrument Data

- **Instrument Brand** and **Instrument Model**
- **University** and **Laboratory**
- **Data Collection Software** and its **Version**
- **Post Processing Software** and its **Version**
- **Instrument Notes**

For TEM, STEM, SEM and Electron Microprobe there is also **Filament Type**, and a **Detectors** section (Type, Make, Model) with **Add Additional Detector**. An instrument chosen from the repository fills these in.

5.3.5 Step 5: Instrument Settings (some instruments)

This step appears for every instrument type except Optical Microscopy, Scanner and Other. Its fields depend on the instrument:

- **SEM:** Acceleration Voltage (kV), Beam Current (nA), Spot Size (µm), Working Distance (mm).
- **Electron Microprobe:** Acceleration Voltage (kV), Beam Current (nA), Spot Size (µm).

- **TEM:** Acceleration Voltage (kV), Beam Current (nA), Spot Size (µm), Aperture, Camera Length (mm).
- **STEM:** the TEM fields plus Camera Binning and Dwell Time (s).
- **EDS and WDS data** add Step Size, Analysis Dwell Time (/pixel), Dead Time, and Calibration / Standard Notes; **EBSD data** adds Step Size and Notes on Crystal Structures Used.
- **FTIR:** Scan Time (s), Resolution (cm^{-1}), Spectral Resolution (cm^{-1}), Wavenumber Range (cm^{-1}), Averaging (number of scans), Spatial Resolution (µm), Background Correction: Frequency and Notes.
- **Raman Spectroscopy:** Excitation Wavelength (nm), Laser Power (mW), Diffraction Grating, Integration Time (s), Objective, Spatial Resolution (µm), Calibration Notes.
- **AFM:** Atomic Mode (Contact, Non-Contact, Tapping), Cantilever Stiffness (N/m), Tip Diameter (nm), Operating Frequency (kHz), Scan Dimensions (pixels), Scan Area (μm^2), Temperature of Room (°C), Relative Humidity (%).

5.3.6 Step 6: Micrograph Metadata

- **Name:** a name for the micrograph.
- **Polished?** If checked, a **Polish Description** field appears.
- **Notes**.

5.3.7 Step 7: Micrograph Orientation

Define the orientation of the reference micrograph with one of three options:

1. **Unoriented Thin Section**: no further information.
2. **Trend and Plunge of Edges/Strike and Dip of Surface**
    - The dialog asks: “Provide **TWO of THREE**: Select the arrow on each edge that represents a lower hemisphere plunge, and enter the trend and plunge information and/or provide the strike and dip of the thin section.”
    - Choose the direction arrow on the top edge and on a side edge of the image, and enter the trend and plunge of those edges, and/or the strike and dip of the thin section surface.

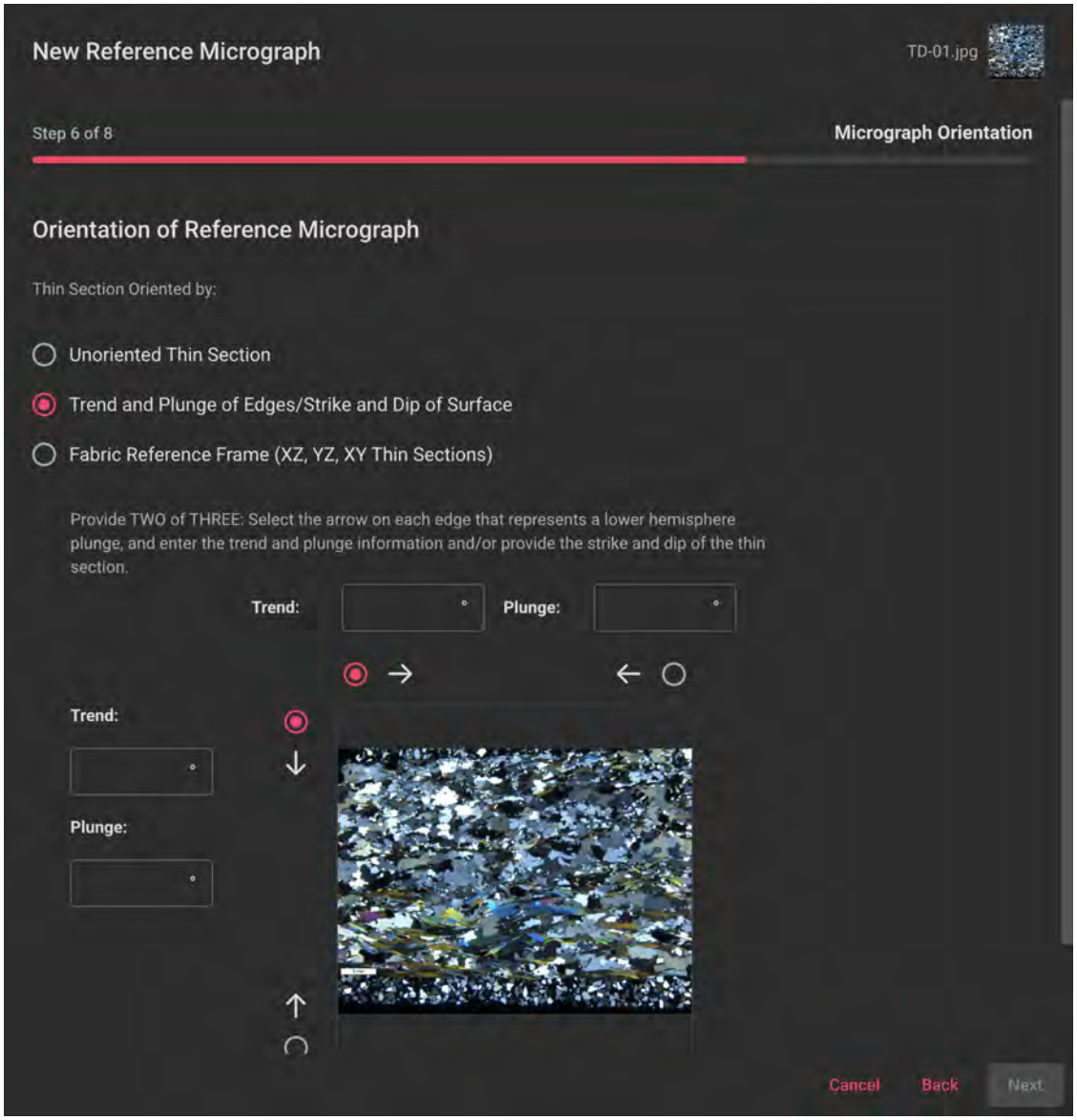


Figure 23. Entering trend and plunge or strike and dip.

3. **Fabric Reference Frame (XZ, YZ, XY Thin Sections)**
    - Choose the section relative to the fabric:
        - **XZ**: lineation (X) and foliation normal (Z)
        - **YZ**: perpendicular to lineation (Y) and foliation normal (Z)
        - **XY**: lineation (X) and perpendicular to lineation (Y), in the foliation plane
    - **Foliation Orientation:** strike and dip (geographic coordinates).
    - **Lineation Orientation:** trend and plunge, or rake (right-hand rule, 0 to 180°).
    - **Look Direction:** "When viewing the reference micrograph, are you looking toward the lower hemisphere or upper hemisphere in geographic coordinates?"

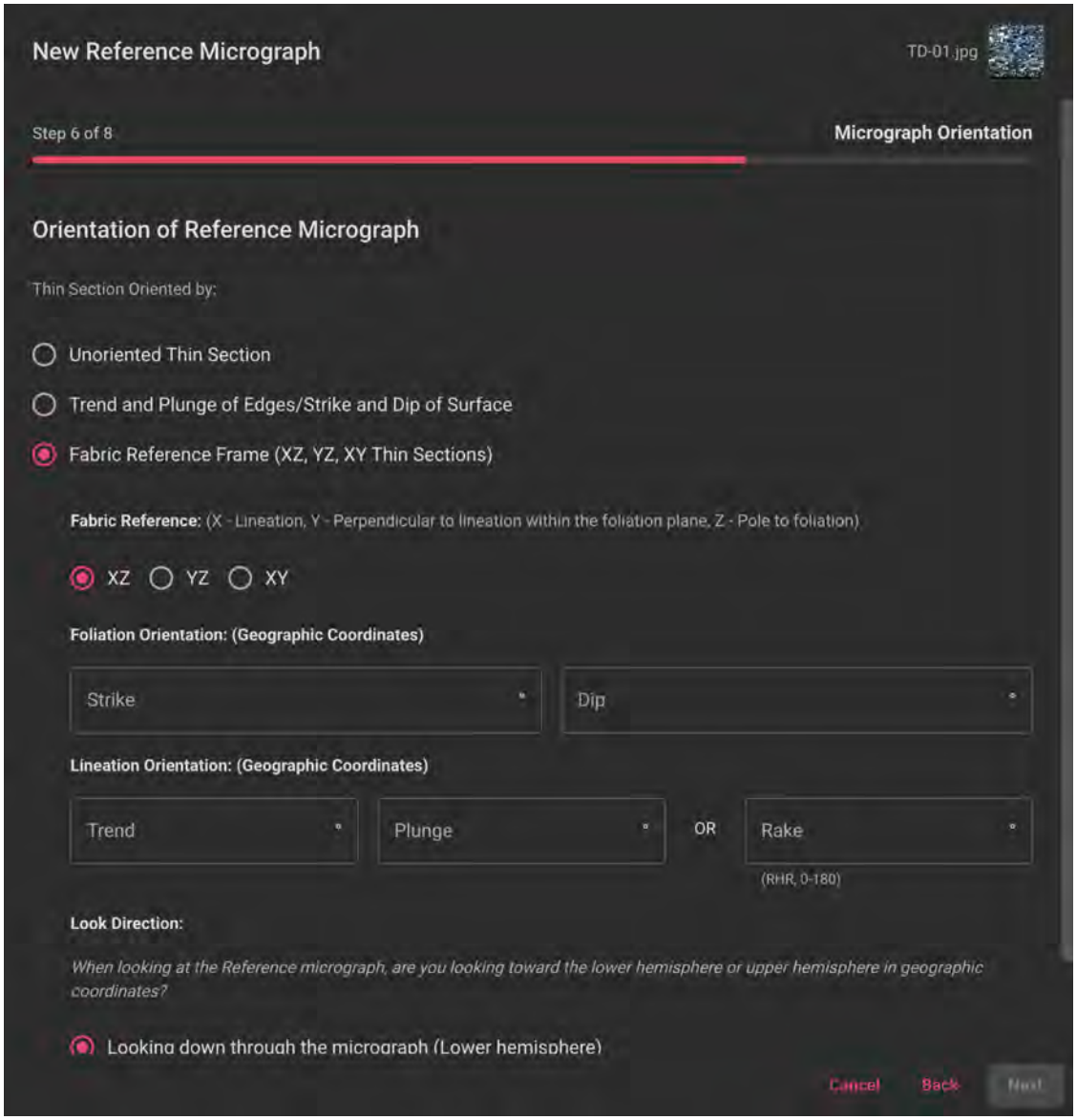


Figure 24. Fabric Reference Frame options.

5.3.8 Step 8: Set Micrograph Scale

Choose how to set the scale:

- **Trace Scale Bar:** draw a line along the scale bar in the image.
- **Pixel Conversion Factor:** enter how many pixels make a given distance.
- **Provide Width/Height of Image:** enter the physical width or height of the whole image.

5.3.9 Step 9: Scale Input

Enter the scale with the method you chose. Units can be µm, mm, cm, m or inches.

- **Trace Scale Bar:** with the **Line Tool (Draw Scale Bar)**, drag a line from one end of the scale bar to the other; the **Line Length (pixels)** is measured. Use the **Pointer Tool (Pan/Zoom)** and the mouse wheel to move and zoom, and **Reset Zoom** to see the whole image. Drawing again replaces the line. Enter the **Physical Length** and **Units** of the scale bar.
- **Pixel Conversion Factor:** enter the number of pixels and the distance they represent.

- **Provide Width/Height of Image:** enter the width or height and the units.

Click **Finish** to add the micrograph to the sample.

5.4 Add an Associated Micrograph

Click the **+** button of the micrograph it belongs on (its parent) and choose `Add Associated Micrograph`, or `Batch Import Associated Micrographs` for several. The **New Associated Micrograph** dialog has the same first steps as a reference micrograph (load, rotation, instrument, instrument data, settings, metadata). Instead of orientation and scale, it then asks where the micrograph is on its parent.

5.4.1 Location Method

- **Locate as a scaled rectangle** (the default): place the image on its parent as a rectangle that you can move, resize and rotate.
- **Locate by an approximate point:** mark a single point showing the approximate location. The micrograph is shown as a red circle marker on its parent.
- **3-Point Registration:** match three or more features in both images; StraboMicro calculates the placement, including any rotation, scaling and distortion between the images.
- **Copy location and scale from an existing micrograph:** reproduce exactly the placement of another micrograph on the same parent, whatever method placed it. Choose it in **Select Micrograph**; the list shows each candidate's size and how it was placed. For a rectangle or 3-point placement, the two images must have the same proportions. If the pixel sizes differ, the scale is adjusted assuming both images cover the same physical width. This option finishes the import. It is useful for several images of the same field of view, such as different detectors or PPL and XPL images.
- **Same area as parent:** the micrograph covers its parent exactly, at the same position and scale, for example element maps collected with the BSE image they belong to. The image must have the parent's proportions, and the parent must have a scale; otherwise the option is not available and says why. This option finishes the import.
- **Place automatically on parent:** StraboMicro finds where the image sits on its parent by matching features in both images, and shows you the result to check (Section 5.4.4). It also works out the scale, so there is no Scale Method step.

5.4.2 Scale Method (rectangle and point)

For **Locate as a scaled rectangle**:

- **Trace Scale Bar and Drag:** trace the scale bar, then drag, resize and rotate the image on its parent.
- **Stretch and Drag:** stretch the image to fit, then drag, resize and rotate it.
- **Pixel Conversion Factor** or **Provide Width/Height of Image**, then place it.

For **Locate by an approximate point**: **Trace Scale Bar**, **Pixel Conversion Factor** or **Provide Width/Height of Image**, then click on the parent to place the point.

Both also offer **Copy scale from an existing micrograph**, for images taken at the same magnification. Choose the micrograph in **Copy scale from**; any micrograph in the project with a scale can be used. The scale is copied as it is, so you only need to put the image in place. If the two images have different pixel sizes, a note reminds you that this is right only when both were taken at the same magnification and resolution.

5.4.3 Micrograph Location & Scale

The placement view shows the parent with the new micrograph on it. Drag the micrograph to move it, drag its handles to resize or rotate it, and set its **Transparency** to see the parent through it. For precise placement, type the position and angle in the **X (px)**, **Y (px)** and **Rotation (°)** fields below the view; the arrow keys change the rotation in 0.1° steps. **Pan Tool**, **Line Tool** and **Reset View** help you navigate. Click **Finish**.

5.4.4 Place Automatically on Parent

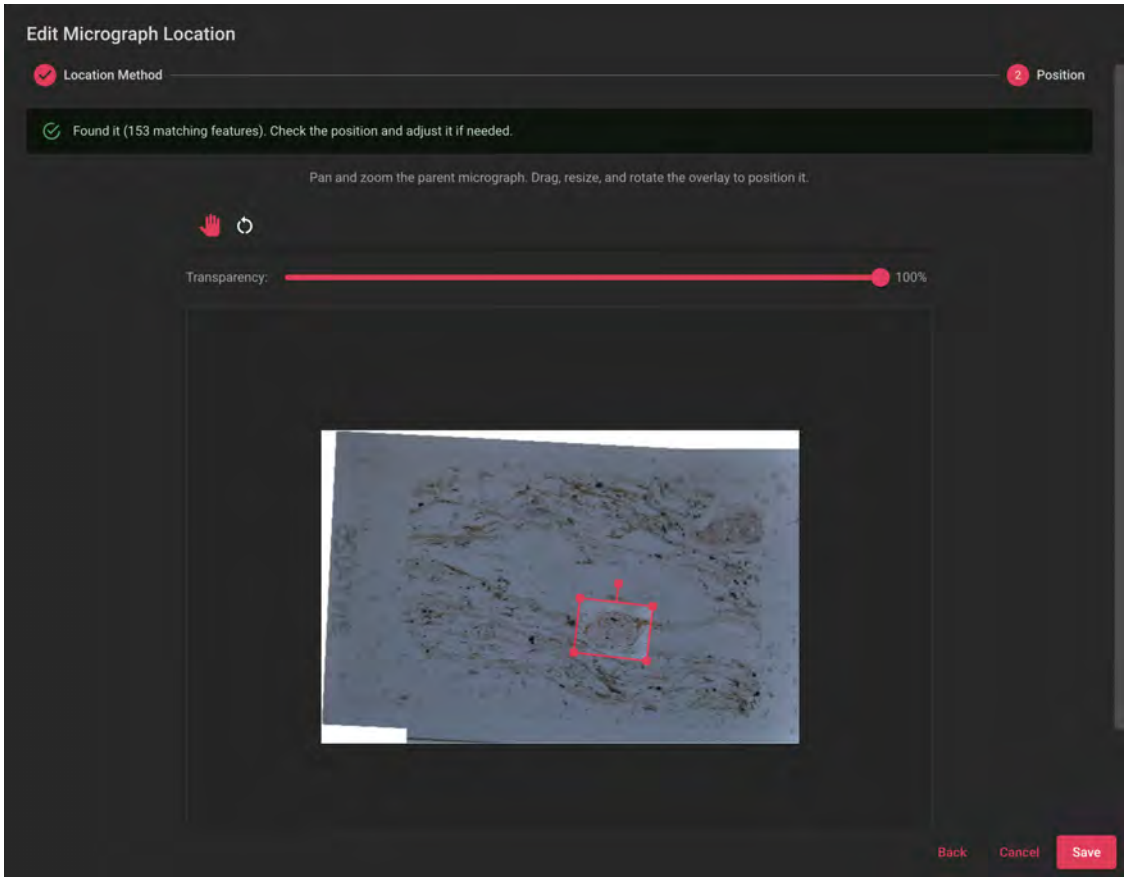


Figure 25. Place automatically on parent: the garnet detail was found on the thin section overview and is shown in place, ready to check.

Choose **Place automatically on parent** as the location method and click **Next**. StraboMicro looks for the image on its parent, which usually takes a few seconds (up to about 15 seconds when there is no match). It compares recognizable features (grain edges, inclusions, opaque minerals) in both images, so it handles images that are turned, finer than the parent, or taken

with different lighting. Your images are never uploaded; the matching runs on your computer. The result is one of these:

- **Found it:** the image is shown on its parent in the placement view (Figure 25). Check it, and drag, resize or rotate it if needed, as in Section 5.4. Click **Finish** (or **Save** in Edit Micrograph Location). The micrograph is saved as a scaled rectangle, and its scale is calculated from the parent's.
- **Low confidence, please check:** fewer features matched. The placement is often still right; compare the image with its parent (lower the **Transparency** to see through it) before you finish.
- **The image needed a slight skew to fit:** the image is saved like a 3-Point Registration (Section 5.4.5), with a preview of its outline on the parent. **Adjust points** opens the registration with three points already set. This also happens when the parent itself (or one of its parents) was placed with 3-Point Registration.
- **No match found**, or **fits more than one place** (a repeating pattern): nothing is placed. Choose **Place as a scaled rectangle** or **Use 3-Point Registration** to place it by hand.

Tips: automatic placement works best when both images show the same kind of view (PPL on PPL, XPL on XPL) and the image is no more than about 8 times finer than its parent. Scale bars and labels burned into the images are ignored. To place many images at once, see Section 5.7.

5.4.5 3-Point Registration

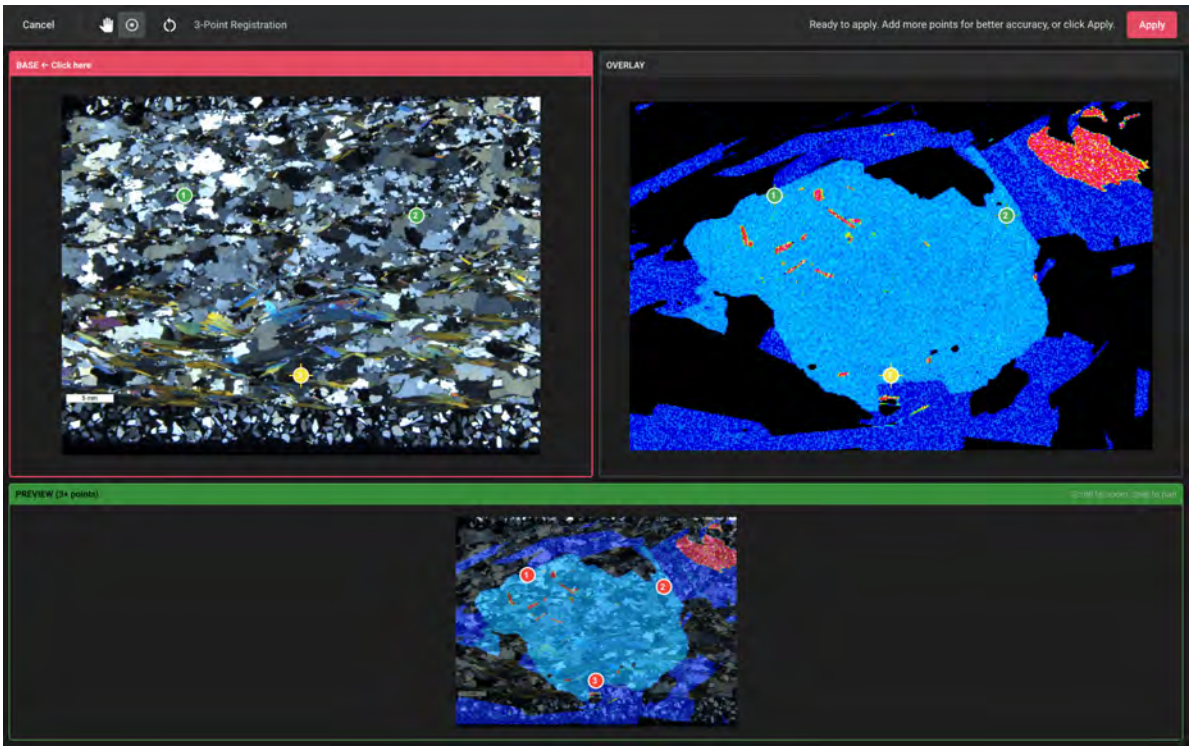


Figure 26. 3-Point Registration: matching points on the BASE (parent) and OVERLAY images, with the preview below.

1. Choose **3-Point Registration** as the location method and click **Start 3-Point Registration**.

2. The registration window shows the parent on the left (**BASE**), the new micrograph on the right (**OVERLAY**), and a **PREVIEW** of the result below.
3. Click a recognizable feature (a grain corner, an inclusion) on the BASE image, then the same feature on the OVERLAY image. Repeat for at least three features. Instructions at the top tell you which image to click next.
4. Drag points to adjust them. Right-click a point to delete it, or select it and press `Delete`. **Reset All Points** (`R`) starts over. Use the **Pan Tool** (`P`) and **Point Tool** (`V`) and the mouse wheel to navigate.
5. When the preview looks right, click **Apply** (or press `Enter`).

Tips: spread the points across the image, choose features that are sharp in both images, and zoom in to place points precisely. More than three points give a better fit.

5.5 Batch Import

`Batch Import Reference Micrographs` (on a sample) and `Batch Import Associated Micrographs` (on a micrograph) add several images at once:

1. **Select Files:** choose the images. **Instrument and Image Info** is checked by default; uncheck it to enter this later. Check **Rotate / Flip Images** if some need rotating.
2. **Instrument & Image Info** and **Instrument Data**: one set of instrument information for all the images. Below the **Image Type**, each image can have its own, for example a mix of PPL and XPL images, or the elements of a set of maps.
3. **Orientation** (reference micrographs only).
4. **Rotation** (if checked): rotate or flip each image.
5. **Import**.

The images are then in the project, and **Finish Importing** opens for what they still need (Section 5.6). A single associated image with its instrument information goes straight to `Edit Micrograph Location`.

A batch imported by mistake is easy to remove: `Delete unplaced children...` in the parent's three-dot menu deletes all of its micrographs that have no location yet.

5.6 Finish Importing

A micrograph that still needs its instrument information, scale or location shows a warning dot in the project tree. **Finish Importing** completes it, together with the others beside it that are not finished. It opens when you click such a micrograph and at the end of a Batch Import. It shows only the steps needed:

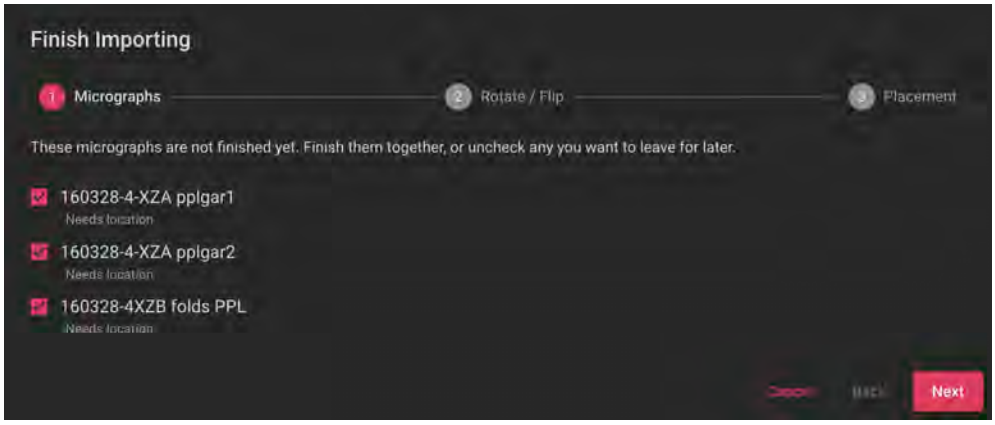


Figure 27. Finish Importing lists the unfinished micrographs on the same parent and what each one needs.

1. **Micrographs:** the unfinished micrographs on the same parent (for reference micrographs, in the same sample) and what each one needs. Uncheck any you want to leave for later. Not shown right after a Batch Import.
2. **Rotate / Flip** (optional): turn or mirror any image that is the wrong way round. This permanently changes its pixels, so it is possible only before the image is placed, and before it has spots or micrographs on it. Not shown right after a Batch Import, which has its own rotation option.
3. **Instrument & Image Info** and **Instrument Data**, for those that need them: entered once for all of them, or copied with **Load Metadata from Previous Image**. Below the **Image Type**, each micrograph can have its own.
4. **Placement** (or **Scale** for reference micrographs), when several need it: see below. A single micrograph goes on to `Edit Micrograph Location` or **Set Micrograph Scale**.

Cancel changes nothing, including any rotation you chose. The rotation and instrument information are saved when you leave the last step before placing; after that, **Later** keeps them, and the warning dot shows what is still missing. Click the micrograph again at any time to go on.

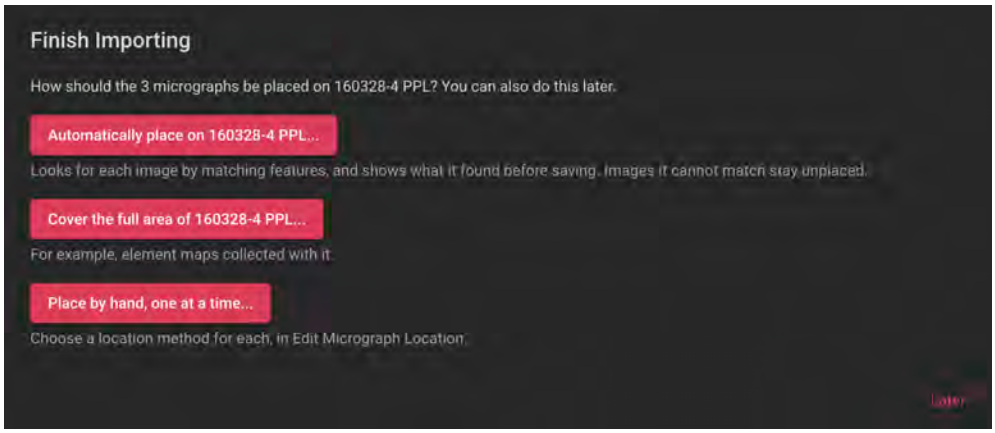


Figure 28. The placement step: each choice places only the micrographs you checked.

The placement step offers these choices for the checked micrographs:

- **Automatically place on [parent]...:** automatic placement (Section 5.7).

- **Cover the full area of [parent]...** and **Copy the placement of a placed micrograph...** (Section 5.8). The second is shown once one micrograph on the parent is placed.
- **Place by hand, one at a time...:** `Edit Micrograph Location` opens for each in turn, with every location method. The title shows which micrograph you are placing and how far along you are (2 of 4). Saving one opens the next; **Cancel** stops, and the rest stay as they are.

The first two need a parent with a scale and, if it is an associated micrograph itself, a location. Until then the step says so, and the other choices remain.

A micrograph with its instrument information that is the only one left goes straight to `Edit Micrograph Location` when clicked. In a shared project, only micrographs your role may change are listed.

5.7 Place Children Automatically

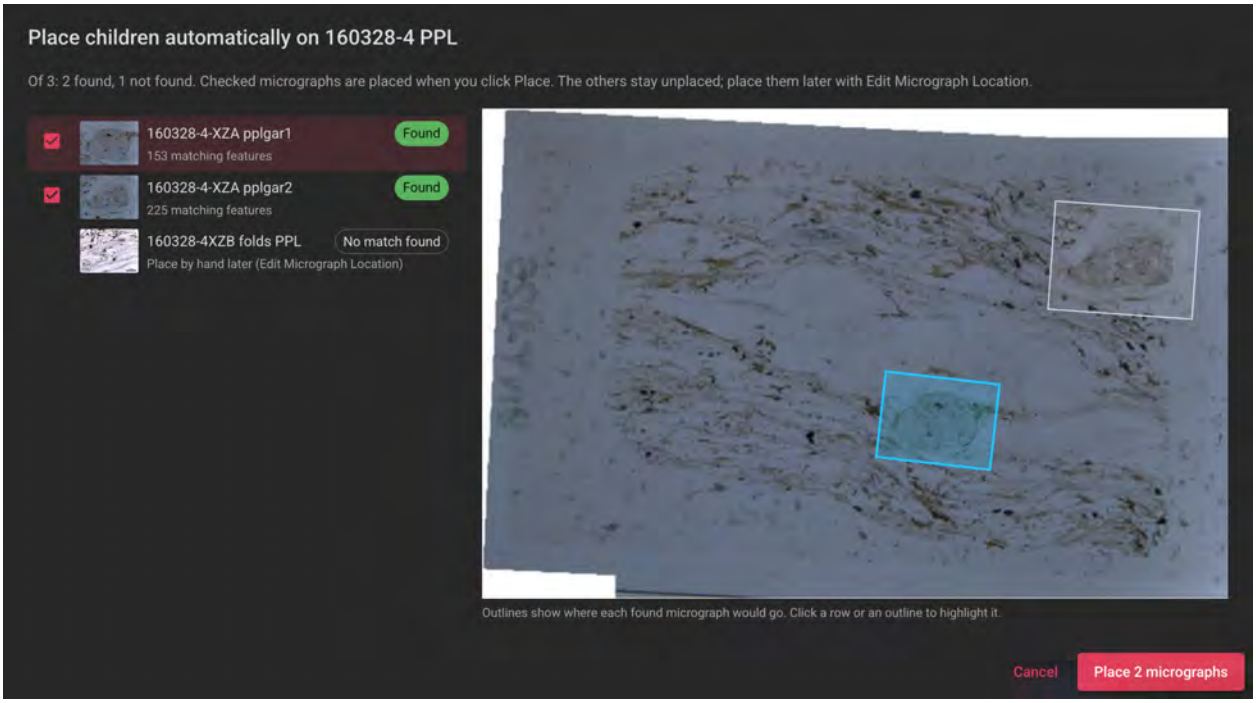


Figure 29. Place children automatically: two garnet details were found (outlines on the parent, the selected one highlighted); the folds image is not on this thin section and stays unplaced.

`Place children automatically...` uses automatic placement (Section 5.4.4) on associated micrographs of a micrograph that have no location yet, for example after a batch import. There are two ways to start it:

- **Automatically place on [parent]...** in Finish Importing (Section 5.6), for the micrographs checked there.
- `Place children automatically...` in the parent's three-dot menu, for all of them. It is shown only when some of its associated micrographs have no location. The parent needs a scale, and if it is an associated micrograph itself, a location.

StraboMicro looks for each micrograph in turn and lists the results (Figure 29):

- **Found**: checked, to be placed.
- **Low confidence**: not checked. Look at its outline on the parent and check it if it is right.
- **No match found** and **Fits more than one place**: these cannot be checked. They stay without a location; place them later with `Edit Micrograph Location`.

The parent on the right shows an outline for each micrograph that was found. Click a row or an outline to highlight it. **Stop** ends the search and keeps the results found so far. Click **Place N micrographs** to place the checked ones; `Edit > Undo` takes all of them back at once. Each placement can be adjusted afterwards with `Edit Micrograph Location`.

5.8 Placing Several Micrographs Together

Besides automatic placement, two more items in the parent's three-dot menu place all of its micrographs without a location in one step. They are useful for a stack of images of one area, such as element maps. Both are shown only when the parent has micrographs without a location:

- `Place unplaced children on its full area...`: each micrograph covers the parent exactly, as with **Same area as parent**. The parent must have a scale.
- `Place unplaced children like...`: each micrograph gets the location, scale and rotation of a micrograph already placed on the same parent. Choose that micrograph in **Place them like**. The item is available once one micrograph on the parent is placed.

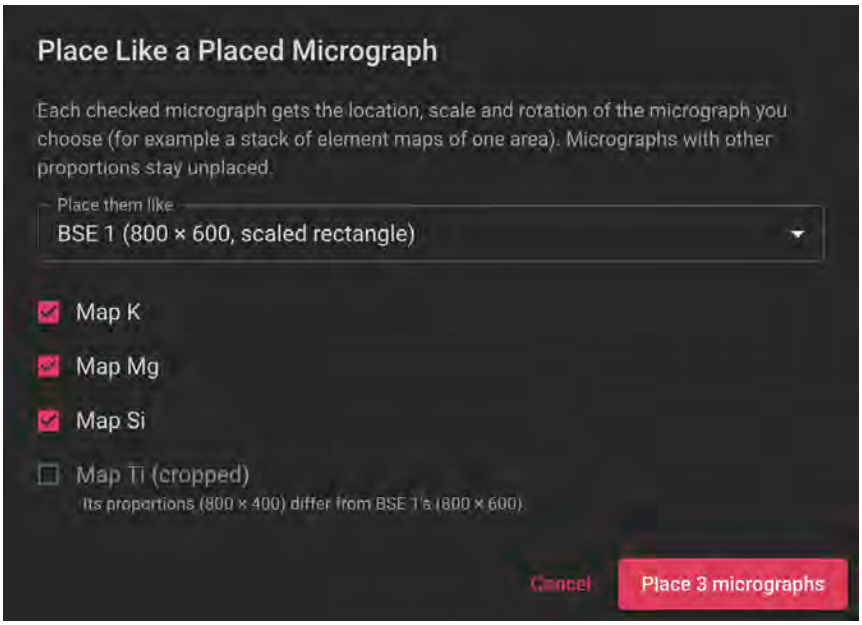


Figure 30. Place Like a Placed Micrograph: three element maps get the placement of the BSE image; the map with other proportions stays unplaced.

The same two are offered in Finish Importing (Section 5.6). Uncheck any micrograph you want to leave out. A micrograph with other proportions cannot be checked and stays without a location; its row gives the reason. If the proportions match but the pixel size differs, the row says that the scale is adjusted on the assumption that the image covers the same width. Click **Place N micrographs**; `Edit > Undo` takes all of them back at once.

5.9 Editing Micrographs

From a micrograph's three-dot menu in the project tree:

- `Edit Micrograph Metadata`: the instrument, instrument data and settings, and metadata steps; for a reference micrograph also **Micrograph Orientation** and **Micrograph Scale**. The scale step shows the current scale; leave it blank to keep it. A new scale is also applied to the micrograph's associated micrographs.
- `Edit Micrograph Location` (associated micrographs): choose the location method again and place the micrograph. For a micrograph placed by 3-point registration, **Edit Registration** reopens its points.
- `Place children automatically...`: places this micrograph's associated micrographs that have no location yet (Section 5.7).
- `Edit Micrograph Opacity` (associated micrographs): a slider for how transparent it is on its parent. `Edit All Associated Micrographs Opacity` on the parent sets it for all of them.
- `Place unplaced children on its full area...` and `Place unplaced children like...` (Section 5.8).
- `Delete Micrograph`: deletes the micrograph with its spots and associated micrographs (undo is available). A micrograph that still needs its scale or location has this one menu item, so you can remove it without completing it first.
- `Delete unplaced children...`: deletes all of this micrograph's associated micrographs that have no location yet. The confirmation lists them.

5.10 Micrograph Visibility

`View > Micrograph Visibility...` (`Cmd+Shift+V` / `Ctrl+Shift+V`) opens a panel in the corner of the viewer listing the associated micrographs drawn on the one you are viewing. For a PPL/XPL pair the list is the same from either image. Micrographs nested deeper, and micrographs without a scale, are not drawn there and are not listed; open a micrograph to work with the ones placed on it. It is the quick way to work through a stack: open a BSE image to step through the element maps placed on it.

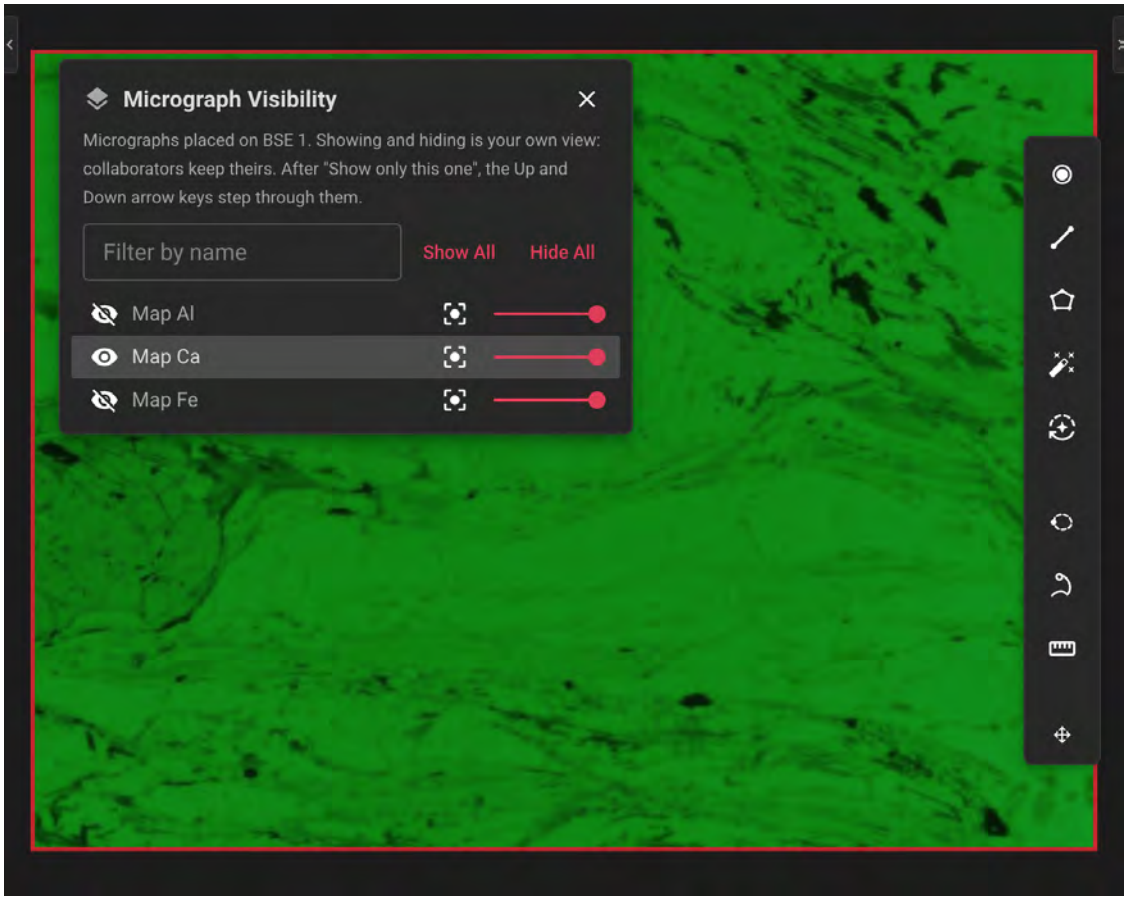


Figure 31. The Micrograph Visibility panel, showing one element map at a time.

- The **eye button** of a row shows or hides that micrograph.
- **Show only this one** (the target button) hides the others. The Up and Down arrow keys then step through the list one micrograph at a time.
- **Filter by name** limits the list. **Show All** and **Hide All** act only on the rows listed, so you can type “map” and hide just the maps.
- The slider of a row sets the micrograph’s opacity.

Showing and hiding is your own view: in a synced project, your collaborators keep theirs. Opacity belongs to the micrograph and is shared.

5.11 PPL/XPL Pairs

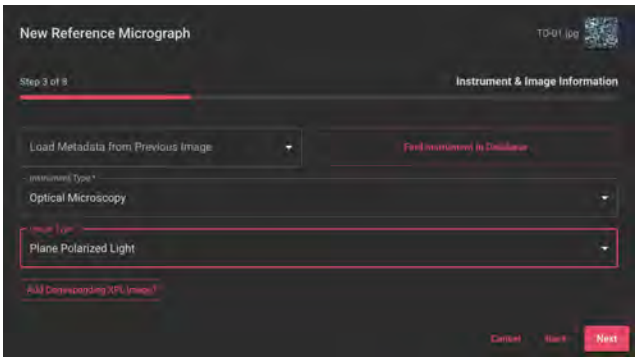
A plane-polarized (PPL) and a cross-polarized (XPL) image of the same area can be linked as a pair. The pair appears as one micrograph in the project tree, and you switch between the two images in the viewer without losing your place. Pairs work for Optical Microscopy (Plane Polarized Light / Cross Polarized Light) and Scanner (Plane Polarized / Cross Polarized) images. Both images of a pair must come from the same instrument and have the same proportions.

5.11.1 Creating a Pair

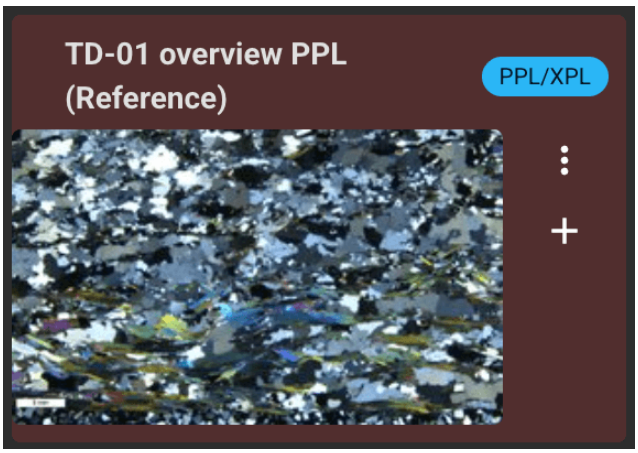
- **While adding a micrograph:** in the Instrument & Image Information step, after choosing a PPL or XPL image type, click **Add Corresponding XPL Image?** (or PPL) and choose the

second image.

- **For a micrograph already in the project:** click its **+** button and choose `Add Corresponding XPL Image` (or `PPL`). Choose the image with **Select XPL Image...**, give it a **Name**, rotate or flip it if needed, and click **Add XPL Image**. The new image gets the same location and scale.
- **For two micrographs already in the project:** in the PPL (or XPL) micrograph's three-dot menu choose `Link Sibling PPL/XPL Image`. The dialog lists the images that can be paired (same sample, same instrument, same proportions, the other polarization, not already paired). Choose one and click **Link Images**. The second image is placed exactly where the first one is.



Adding the corresponding image while adding a micrograph



The PPL/XPL chip of a pair in the project tree

Figure 32. Creating a PPL/XPL pair.

5.11.2 Working with a Pair

- In the project tree, the pair is shown as the PPL micrograph with a **PPL/XPL** chip.
- Press `X`, or click the swap button at the top right of the viewer ("Toggle to XPL view (X)"), to switch between the two images. The zoom and position stay the same.
- Spots are shared: spots drawn on either image appear on both, and new spots are stored with the PPL image.
- Associated micrographs and spots placed on either image are shown on both. Associated micrographs attached to the XPL image are listed under the pair, after the PPL's own, under the caption "On *XPL name*".
- To separate the two images, choose `Unlink Sibling Image` in the pair's three-dot menu.

5.12 Spot Management

Spots are a central concept in StraboSpot, representing spatial observations at multiple scales. In StraboMicro, a spot might represent a grain, a mineral inclusion, a transect, or any localized feature within a thin section or micrograph.

5.13 Adding a New Spot

5.13.1 Spot Tools

The spot tools are on the drawing toolbar on the Micrograph Viewer (Section 4.6):



Point Spot (P): for discrete features such as mineral grains or points of interest.



Line Spot (L): for linear features such as foliations, transects or crystal boundaries.



Polygon Spot (G): for areas such as individual grains, mineral zones or deformation domains.



Grain Spot (W): click a grain and its outline becomes a polygon spot (Section 5.15).

5.13.2 How to Add a Spot

1. **Choose the spot type:** a point, a line or an area (polygon).
2. **Click its button** in the toolbar (or press its key). The active tool is highlighted.
3. **Navigate** as needed: drag to move the image and scroll to zoom. Dragging does not place a spot.
4. **Draw the spot:**
   - **Point:** click once.
   - **Line:** click to add each vertex; double-click the last point to finish.
   - **Polygon:** click each corner; double-click the last corner to close the shape.
5. **Fill in the spot information:** the **Create New Spot** dialog appears (Figure 33).
6. Click **Create Spot**. The spot appears on the micrograph and is selected; its data is shown in the Metadata Pane.

Tip: To stop drawing without placing a spot, click the active tool again, choose **Pan and Select** in the header, or press V. In auto spot mode, Esc also ends drawing.

5.13.3 The New Spot Dialog

- **Name** (required).
- **Notes**.
- **Apply Presets:** choose Quick Spot Presets to apply to the new spot (shown when the project or your computer has presets; Section 7.4).
- **Tags:** choose the project's tags for the spot. The next new spot in the project starts with the tags you chose last, until you close the app, so tagging a run of spots takes no extra steps. A preset that adds tags puts them in this field.

- **Spot Color** and **Opacity**.

To change these later, click the pencil of the **Spot Metadata** section in the Metadata Pane, or right-click the spot and choose `Edit Spot Metadata`. The **Edit Spot** dialog has the same fields.

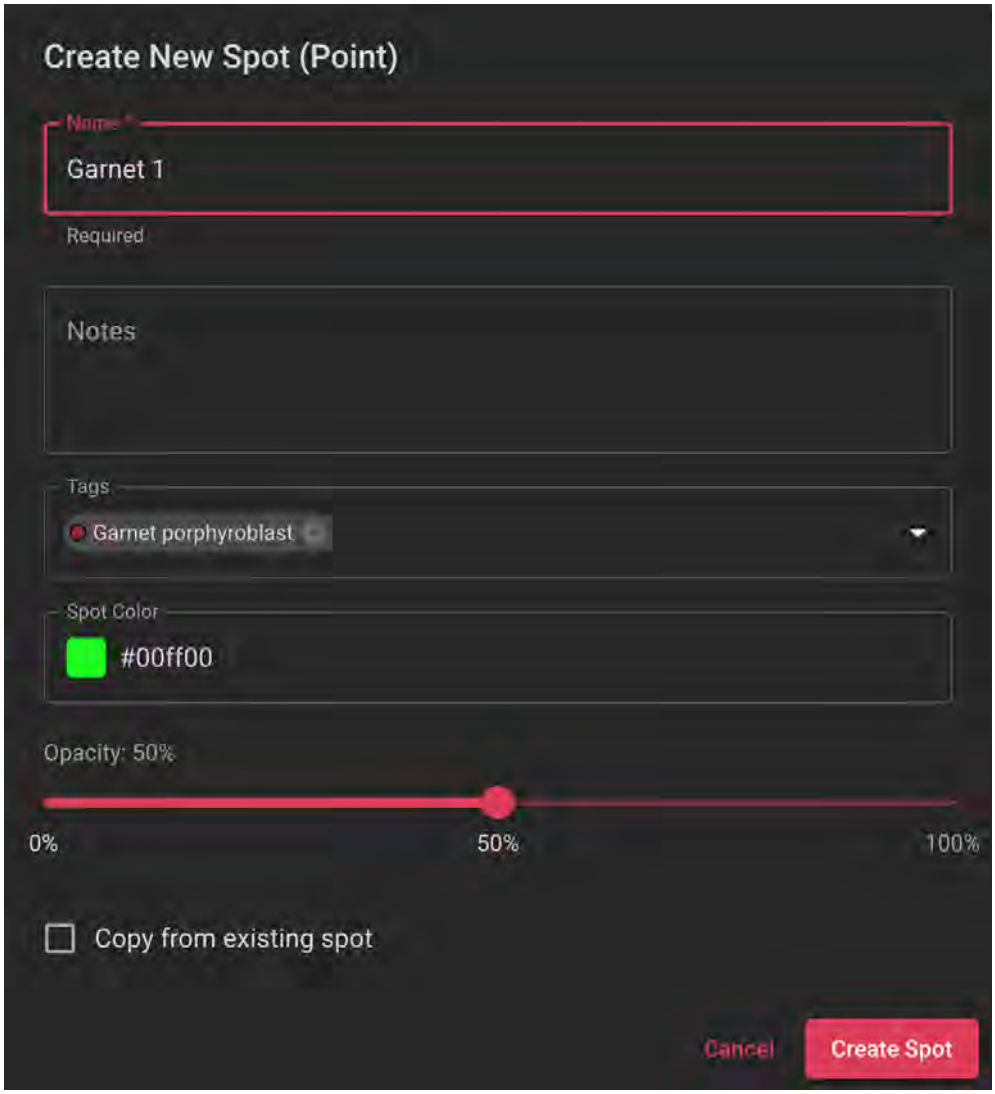
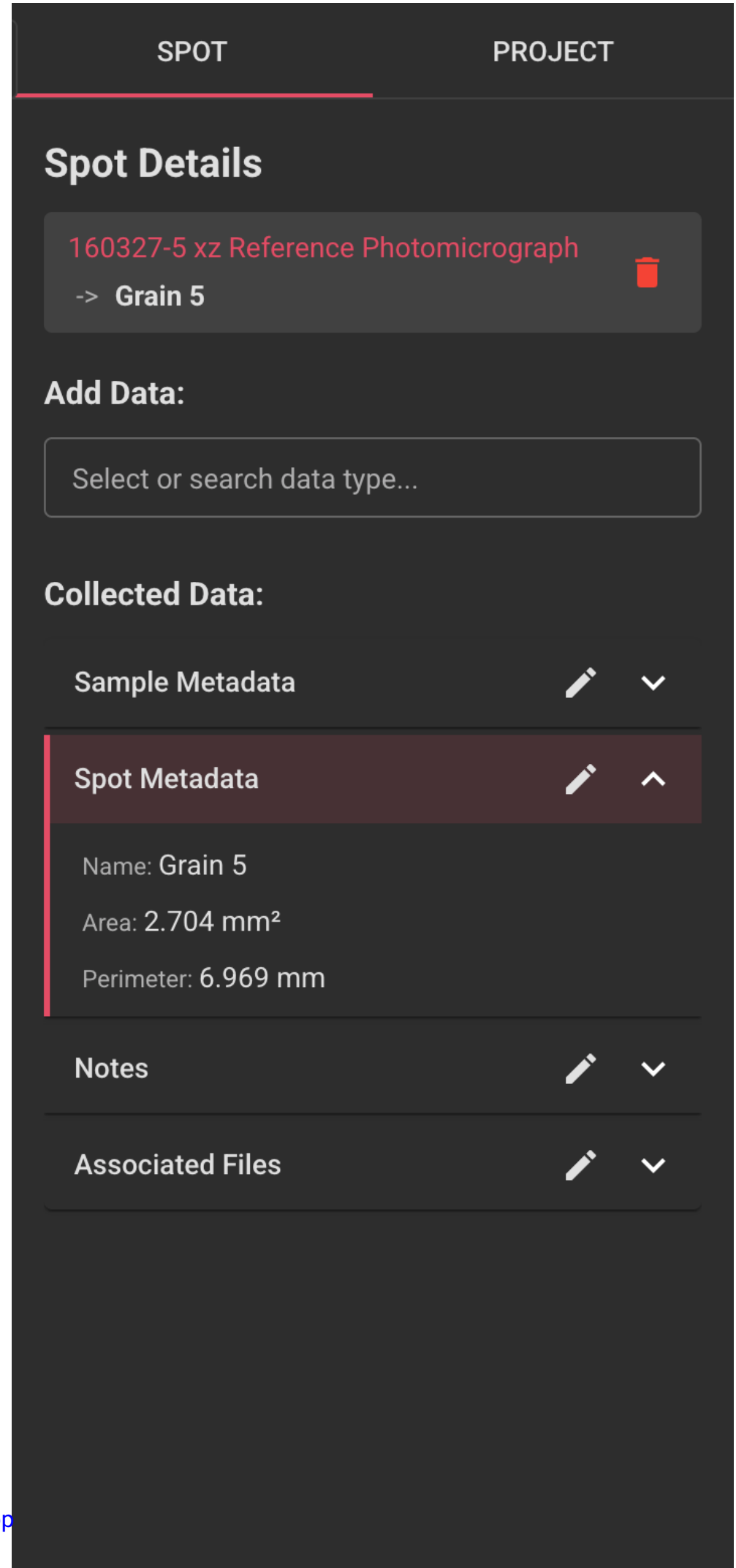


Figure 33. The Create New Spot dialog.


SPOT
PROJECT
Spot Details
160327-5 xz Reference Photomicrograph
-> Grain 5
Add Data:
Select or search data type...
Collected Data:
Sample Metadata
Spot Metadata
Name: Grain 5
Area: 2.704 mm²
Perimeter: 6.969 mm
Notes
Associated Files

5.14 Auto Spot Mode

Auto spot mode places spots without a dialog for each one, which is much faster when you mark many grains or analysis points. Each spot is saved as soon as you place it and named from a pattern: Spot 1, Spot 2, and so on, or Ol-1, Ol-2 with a preset.

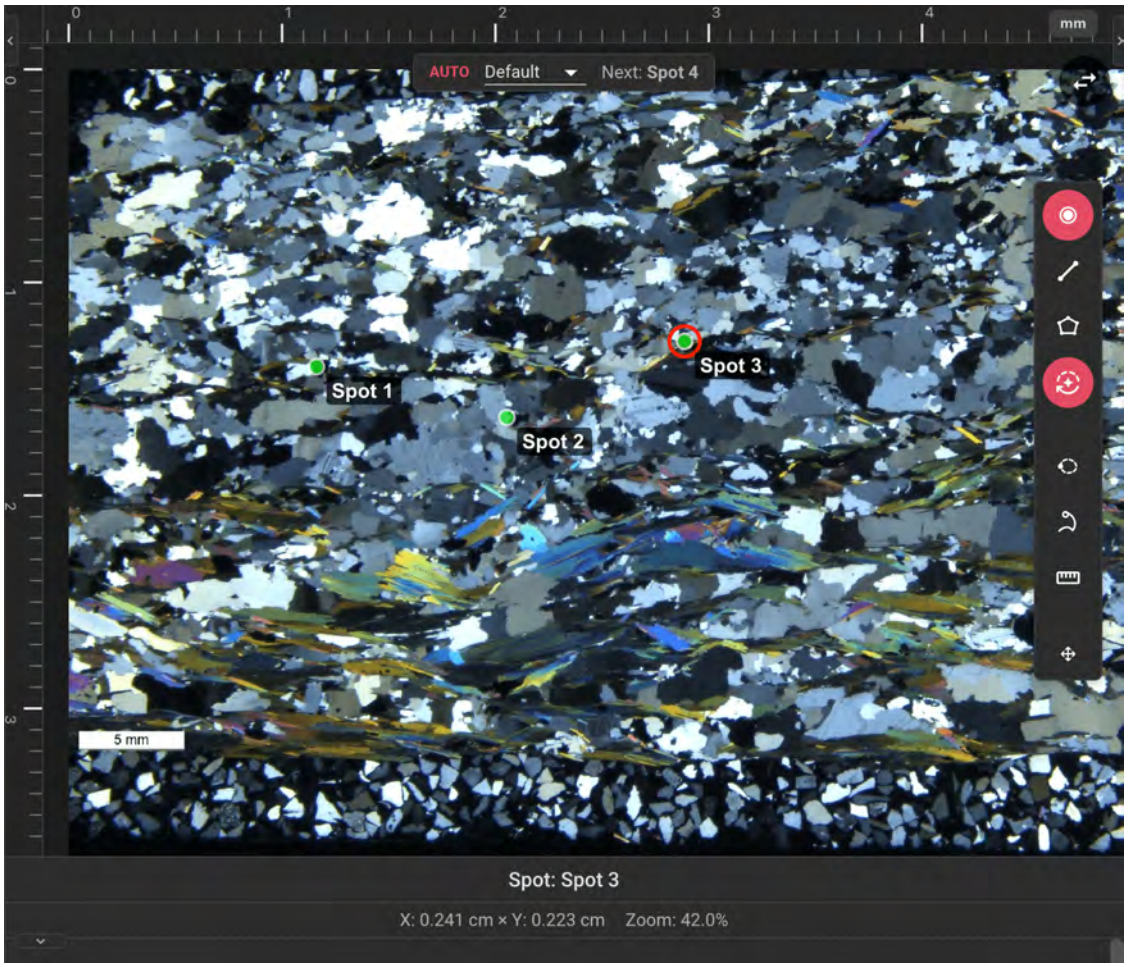


Figure 35. Auto spot mode: the AUTO bar at the top of the viewer shows the preset in use and the name of the next spot.

5.14.1 Placing Spots

1. Turn on the **Auto spot mode** button on the drawing toolbar (below Polygon Spot). It stays on until you turn it off; it is a setting on your computer.
2. Choose **Point Spot**, **Line Spot** or **Polygon Spot**. A bar appears at the top of the viewer: **AUTO**, the preset in use, and the name of the next spot (“Next: Spot 7”).
3. Click to place a point; for a line or polygon, double-click to finish it. The spot is saved immediately and the tool stays active for the next one.
4. Press `Esc` or choose another tool to stop.

Each auto spot is its own undo step, so `Cmd+Z` removes the last one. Auto spots are ordinary spots: rename them or add data at any time.

To give one spot a different name or data, hold `Option` (macOS) or `Alt` (Windows, Linux) while clicking (for a line or polygon, on the finishing double-click). The New Spot dialog opens, already

filled in.

5.14.2 Names

- **Default:** spots are named “Spot {n}”, where {n} is the number.
- **Project pattern:** set **Default Spot Name (auto spot mode)** in `File > Edit Project`, for example “Grain {n}”. A pattern without {n} gets the number at the end.
- **Preset pattern:** give a Quick Spot Preset a **Spot Name**, such as “Ol-{n}” (Section 7.4). Choose that preset in the bar at the top of the viewer, or press its number key (1 to 9). Each spot gets the preset’s name, color and data: Ol-1, Ol-2, ...

Numbers continue across all micrographs of the sample, from the highest number already used for that name; gaps are not filled. In a shared project, your collaborators use the same name patterns, but each person turns auto spot mode on or off for themselves.

5.15 Grain Spot

Grain Spot outlines a grain where you click and saves the outline as a polygon spot, so you do not have to trace it corner by corner. It works on the part of the micrograph you see on the screen, one grain per click, and you stay in control of which grains become spots. (To outline every grain of a micrograph at once, see Grain Detection, Section 7.2.)



Figure 36. Grain Spot in auto spot mode: six grains outlined with one click each, saved as Spot 1 to Spot 6. The status line at the bottom says what to do and where the view was analyzed (here on the GPU, in 0.2 s).

5.15.1 The Grain Model

Grain Spot uses SAM 2.1 (Segment Anything, by Meta; open source). The first time you choose the tool, StraboMicro asks to download the grain model once (about 143 MB, from Hugging Face). It is kept in the application's settings folder; after that Grain Spot works offline, and no image leaves your computer. If the download does not finish, the dialog says why and offers **Try Again**; **Not Now** puts the tool down.

5.15.2 Outlining Grains

1. Choose **Grain Spot** on the drawing toolbar (the magic wand below Polygon Spot), or press `W`. The status line at the bottom of the viewer says **Click a grain to outline it**.
2. Pan and zoom so the grains you want are on the screen. Zooming is how you choose the scale: zoom in for fine grains, out for coarse ones. After each pan or zoom the view is analyzed again (**Preparing grains…** shows if this takes a moment).
3. Move the mouse over a grain: its outline is shown before you click.
4. Click the grain. Its outline becomes a polygon spot. Without auto spot mode the **Create New Spot** dialog opens; in auto spot mode (Section 5.14) the spot is saved at once with the next name, so you can click one grain after another.

Each grain is its own undo step (`Cmd+Z`). A click inside an existing spot selects that spot instead of making a new one. `Esc` puts the tool down.

5.15.3 Correcting an Outline

If an outline missed part of a grain or ran into a neighbour, correct it with more clicks on the same grain:

- `Shift+Click` a part that is missing: it is added to the grain.
- `Cmd+Click` (macOS) or `Ctrl+Click` (Windows, Linux) a part that does not belong: it is cut from the grain.

While `Shift` or `Cmd`/`Ctrl` is held, the outline under the mouse shows the result. The correction changes the last grain you outlined (the same spot, not a new one) and is one undo step. Corrections work until you edit that spot's shape by hand.

5.15.4 Messages

- **That grain runs off the screen.** The grain touches the edge of the viewer, so part of it is not visible. Zoom out or pan to see all of it, then click it again. (A grain at the edge of the micrograph itself is fine.)
- **No grain found there.** Click nearer the middle of the grain, or zoom in.
- **GPU** or **CPU** at the end of the status line, with a time: where the last view was analyzed and how long it took. On computers with a suitable graphics card it takes a fraction of a second; otherwise the processor does it in a second or a few, and everything else works the same.

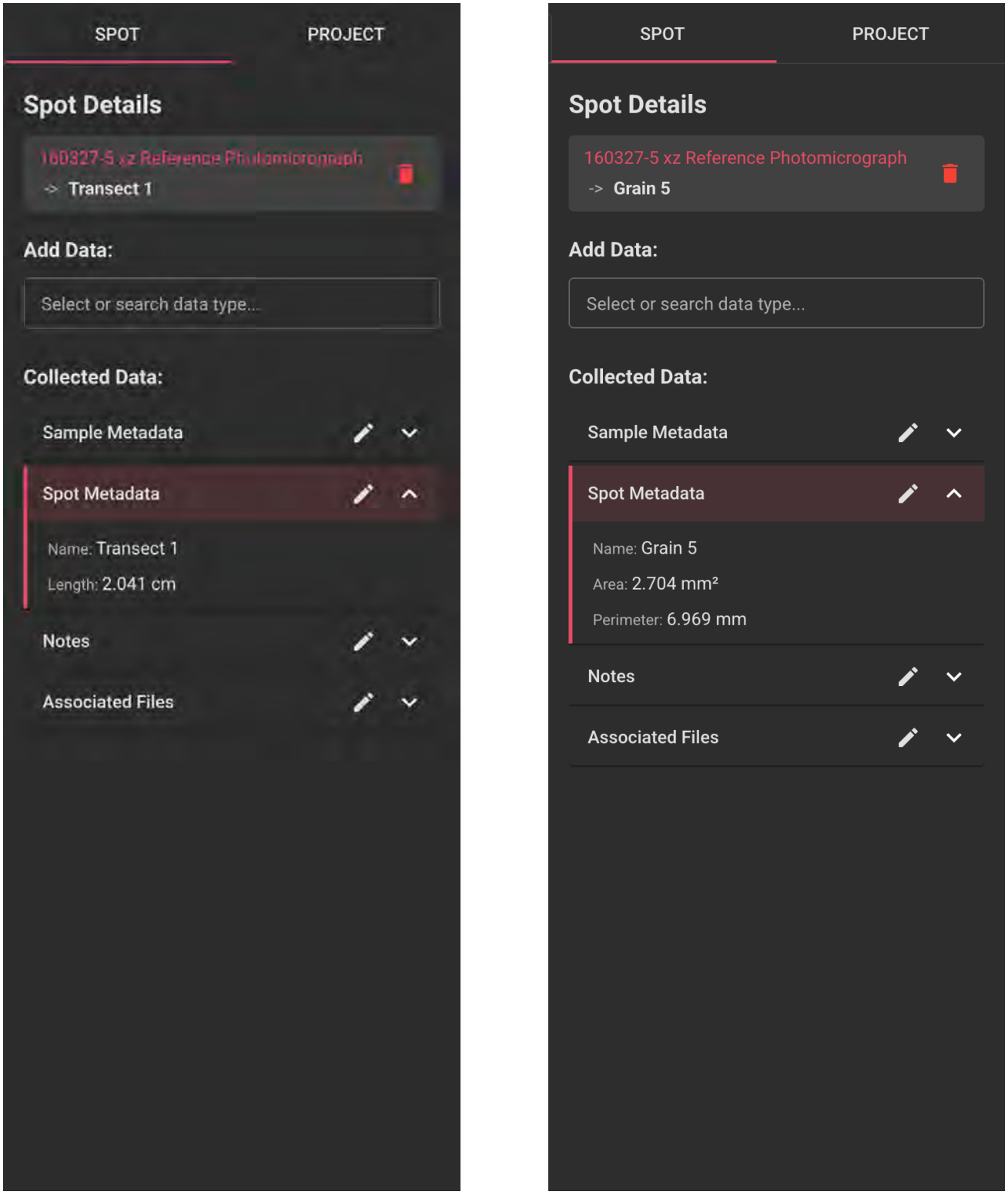
Grain Spot works best on grains with a visible boundary. It struggles with very fine-grained matrix seen from far away (zoom in first) and with neighbouring grains that look the same.

5.16 Real-World Spot Measurements

When the micrograph has a scale, the **Spot Metadata** section shows the size of line and polygon spots:

- **Line spots: Length** (the total length of all segments).
- **Polygon spots: Area** and **Perimeter**.

The unit is chosen from the size: lengths under 1 mm in µm, up to 1 cm in mm, and larger in cm; areas under 1 mm^2 in μm^2, up to 1 cm^2 in mm^2, and larger in cm^2.



(a) Line spot

(b) Polygon spot

Figure 37. Measurements of a line spot and a polygon spot.

5.17 Selecting and Editing Spots

5.17.1 Selecting Spots

With **Pan and Select** active:

- **Click** a spot to select it. Click an empty area to deselect.

- **Cmd+Click** (macOS) or **Ctrl+Click** (Windows/Linux) adds a spot to the selection, or removes it.
- **Lasso:** hold `Shift` and drag around spots, or use the **Lasso Select** button. Spots whose center is inside the lasso are selected (replacing the previous selection).

The number of selected spots is shown under the viewer.

Overlapping spots: larger polygons are drawn first, then lines, then points, so a smaller spot inside a larger one is on top and gets the click. Where that is not enough, right-click: **Select Spot Here** at the top of the menu lists every spot under the cursor, top first (Figure 38). Click a name to select that spot.

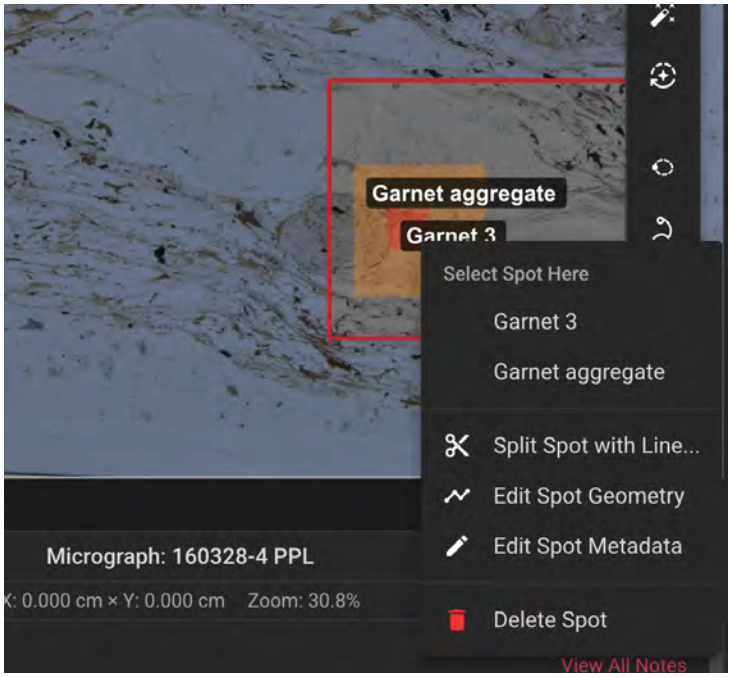


Figure 38. Select Spot Here lists the spots under the cursor when spots overlap.

5.17.2 The Spot Menu

Right-click a spot for:

- `Edit Spot Metadata`: name, notes, presets, color and opacity.
- `Edit Spot Geometry`: move the spot or reshape it (below).
- `Split Spot with Line...` (polygons; Section 5.18).
- `Delete Spot`.

With several spots selected, the menu offers `Edit N Selected Spots...`, `Merge N Selected Spots` (polygons) and `Delete N Selected Spots`.

5.17.3 Editing a Spot's Shape

Choose `Edit Spot Geometry`. Handles appear on the spot: drag a vertex (or a point spot) to move it, or drag the small handle in the middle of an edge to add a vertex there. Click **Save Edits** at the top of the viewer to keep the changes, or **Cancel**.

5.17.4 Editing Several Spots at Once

1. Select the spots.
2. Choose `Spot > Edit Selected Spots...` (`Cmd+Shift+B` / `Ctrl+Shift+B`), or right-click and choose `Edit N Selected Spots...`.
3. In the **Edit *N* Spots** dialog, check each property to change: **Primary Mineral**, **Color**, **Opacity** and **Links**, and set its new value. For **Links**, fill in a label and URL and click **Add** for each link.
4. Click **Apply to *N* Spots**.

Links are added to each spot's existing links; a spot that already has a link's URL does not get it twice. If you filled in a link but did not click **Add**, StraboMicro asks whether to add it before applying.

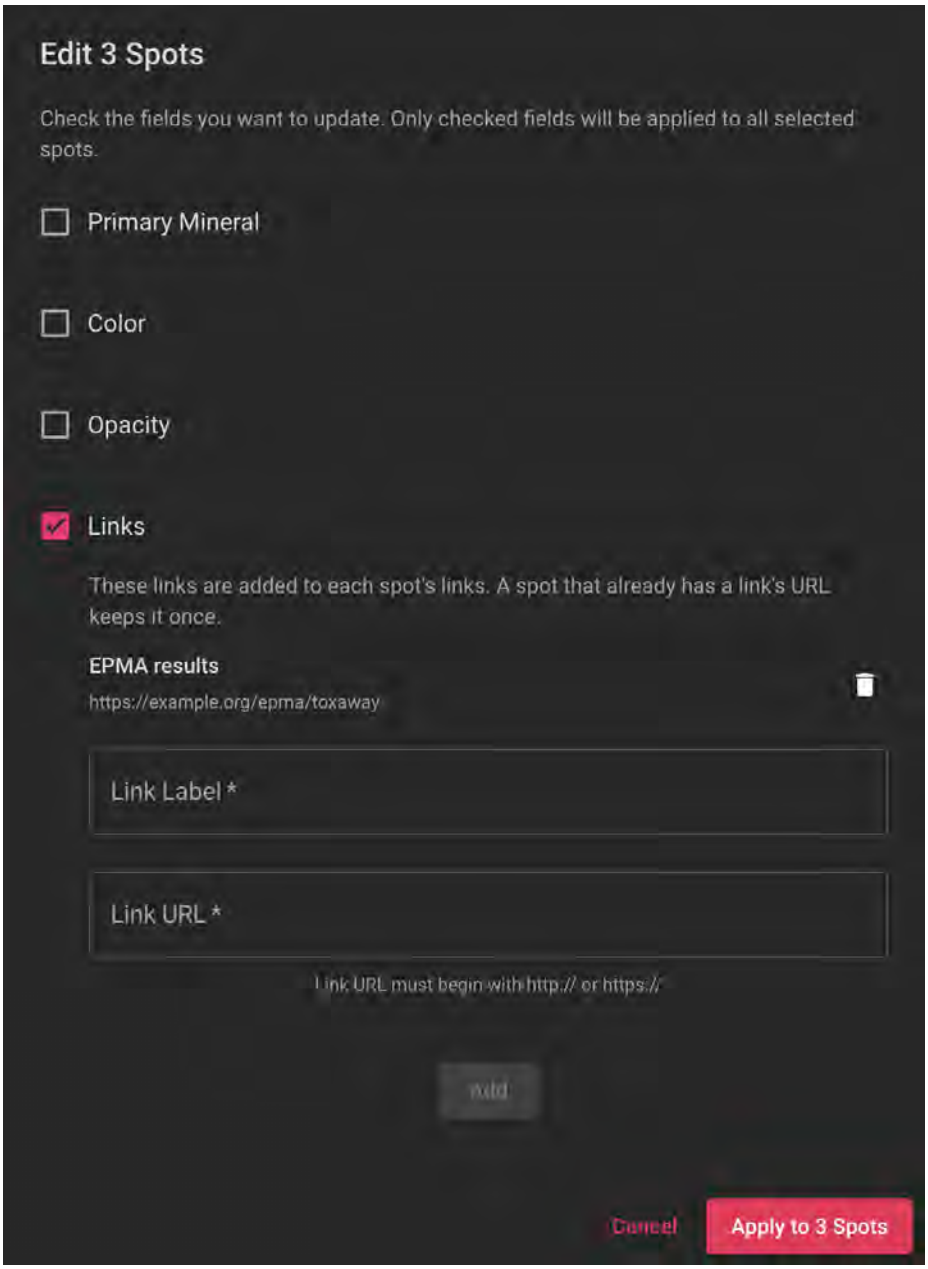


Figure 39. Editing several spots at once.

To apply complete sets of data to many spots, use Quick Spot Presets or Quick Edit (Section 7).

5.17.5 Filtering Spots

`View > Filter Spots...` (`Cmd+Shift+F` / `Ctrl+Shift+F`) shows only the spots that have, or do not have, data in chosen sections, for example every spot that does not have a link yet.

1. Choose `View > Filter Spots...`. The **Filter Spots** panel opens in the top-left corner of the image; you can keep working while it is open.
2. For each section you care about, click **Has** or **Doesn't have**. The sections are the ones in **Add Data** (Mineralogy/Lithology, Grain Size/Shape/SPO, Fabrics, …, Notes, Associated Files, Links) plus Custom User Data. With several choices, a spot must meet all of them. **Any** turns a section off again.
3. Under **Spots that don't match**, choose **Dim** (drawn faint, without a label) or **Hide**.
4. Click **Done** to close the panel. The filter stays on.

While a filter is on, a notice in the bottom-left corner of the image shows how many spots on the micrograph match ("Filtered: 12 of 40 spots match"), with **Edit** to change the filter and **Clear** to end it. The filter also applies to recursive spots and the Spots tab, and a lasso selection picks only the spots that match: to add a link to every spot that has none, filter for Links: **Doesn't have**, Shift+drag a lasso around them and use Edit Selected Spots.

The filter is a view setting on your computer only. It is not saved in the project, your collaborators do not see it, and it ends when you close or reopen the project.

5.17.6 Deleting Several Spots

Select the spots, right-click one of them and choose `Delete N Selected Spots`, then confirm. `Edit > Clear All Spots...` deletes every spot on the current micrograph. Deleting can be undone with `Cmd+Z` / `Ctrl+Z`.

5.18 Merge and Split

5.18.1 Merging Polygons

1. Select two or more polygon spots.
2. Choose `Spot > Merge Selected Spots` (`Option+Cmd+M` / `Alt+Ctrl+M`), or right-click and choose `Merge N Selected Spots`.

The polygons are replaced by one new polygon named "Merged (*N* spots)", which covers all of them (polygons that do not touch are joined by their outer outline). It takes the color, opacity and mineralogy of the first selected spot. Merging works only on polygons.

5.18.2 Splitting a Polygon

1. Select one polygon spot.

2. Choose `Spot > Split Spot with Line...` (`Cmd+/` / `Ctrl+/`), or right-click it and choose `Split Spot with Line...`.
3. Draw a line across the polygon: click outside it to start, click to add bends, and double-click outside it on the other side.

The polygon is replaced by two polygons, each named "*name* (split)" with the original's properties. The line must cross the polygon completely. Press `Esc` to cancel.

Merge and split can be undone and redone (`Cmd+Z`, `Cmd+Shift+Z`).

5.19 Recursive Spots

`View > Show Recursive Spots` (`Cmd+Shift+R` / `Ctrl+Shift+R`) shows the spots of a micrograph's associated micrographs on the micrograph itself, so you can see the annotations made at higher magnification in their context.

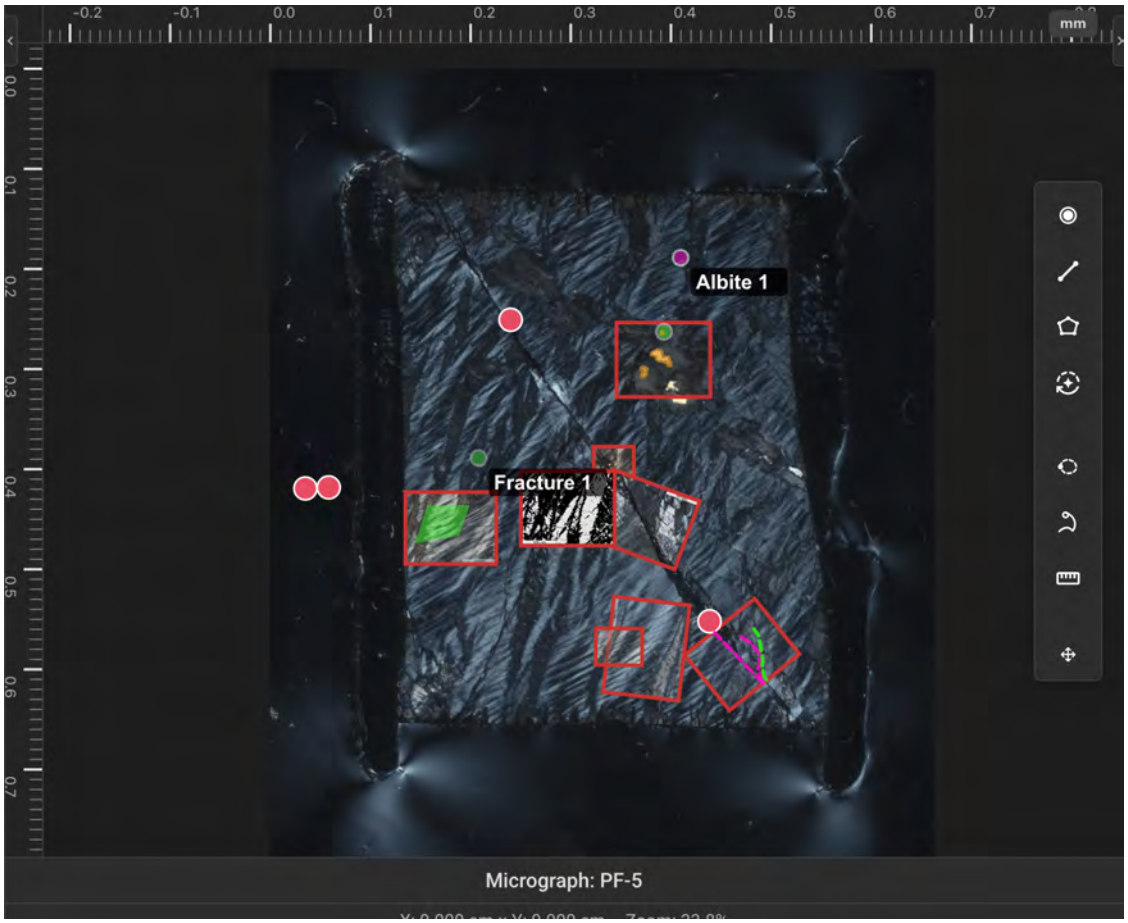


Figure 40. Recursive spots: the line spots of an associated micrograph (pink and green) shown on its parent.

- The spots are drawn at their true position, size and rotation on the parent, including for micrographs placed by 3-point registration.
- Spots of the micrograph's direct associated micrographs are shown (micrographs placed by an approximate point are not included).
- Click a recursive spot to select it and see its data. Its right-click menu offers the usual

items except splitting and geometry editing; to change its shape, open the micrograph it belongs to.

5.20 Parent Spots

`View > Show Parent Spots` works the other way round: on the micrograph you are viewing, it shows the spots of every micrograph it is placed on, for example the reference micrograph's spots on an element map. StraboMicro remembers the setting.

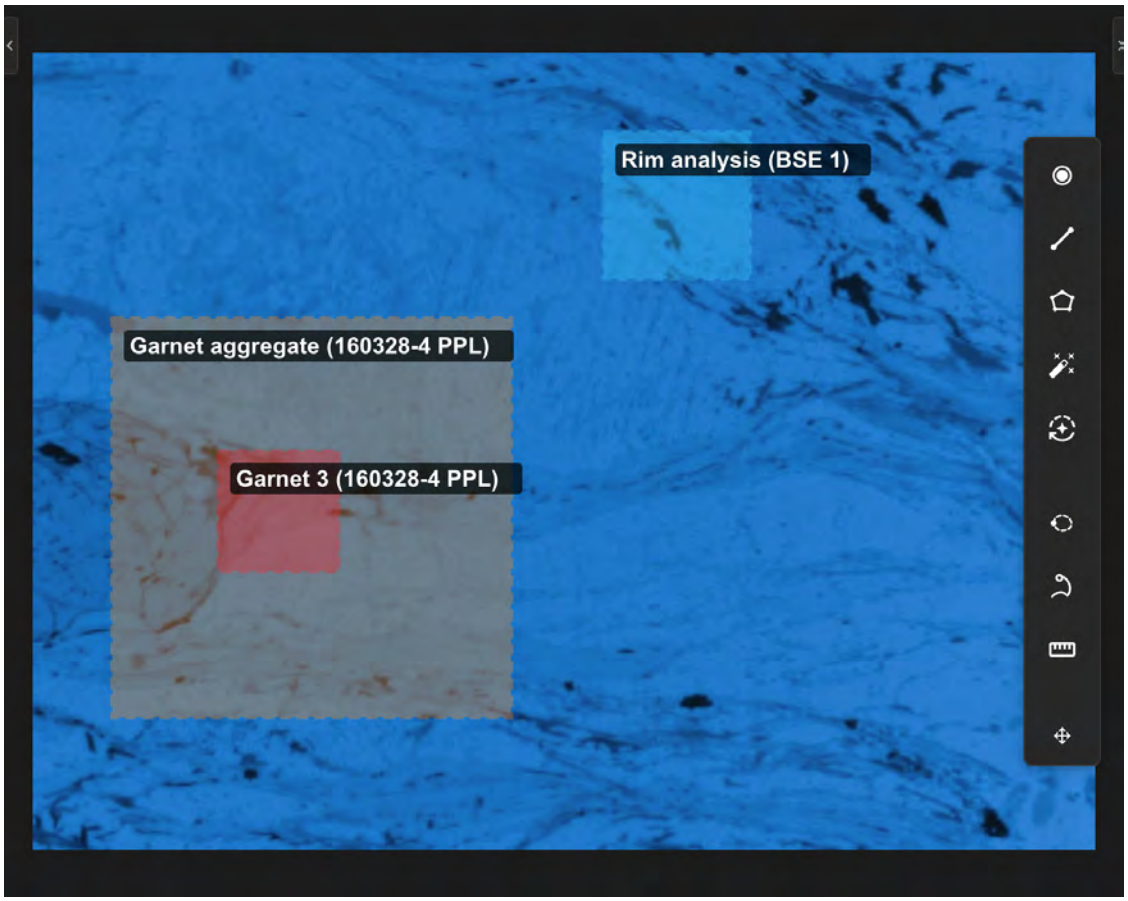


Figure 41. Parent spots on an associated micrograph: faded and dashed, each labelled with the micrograph it belongs to.

- The spots are faded and dashed, and labelled with their micrograph, such as "Garnet 3 (Overview)". They are cut off at the edges of the image.
- Spots from all levels above are shown, for micrographs placed as a scaled rectangle or by 3-point registration. A micrograph placed by an approximate point has no area on its parent, so nothing above it can be shown.
- Parent spots cannot be selected or edited here. Right-click one and choose `Go to Spot on [micrograph]` to open it where it was made.

5.21 Spot Navigation

The **Spots** tab of the Project Navigation Pane lists all spots of the project, by micrograph. Click a spot name to:

- open its micrograph in the viewer,
- select the spot (outlined in red), and
- show its data in the Metadata Pane (see Figure 34).

The **Tags** tab lists spots by tag in the same way (Section 4.4).

6 Data Entry and Observation Tools

StraboMicro provides a flexible framework for entering detailed observational data across multiple spatial contexts. Users can choose to associate data with an entire **micrograph image**, a specific **point (spot)**, a **line** representing a transect or trace, or a **polygon** outlining an area of interest. This structure allows observations to be scaled and shaped according to the nature of the feature being studied, ranging from localized points and linear structures to broader areas or the full thin section.

In addition, features and observations can be explicitly linked to previously defined mineralogical or lithological classifications, supporting consistent interpretation and integrated analysis.

This section describes how to enter data at each spatial level and outlines the types of information that can be recorded within each context.

6.1 Adding Data

To begin entering data:

- **To add data to a micrograph:** Click anywhere on the micrograph (not on a spot) to ensure it is selected and active.
- **To add data to a spot:** Click the spot to select it. When active, the spot will be outlined in red and its metadata panel will appear on the right (see Figure 42).

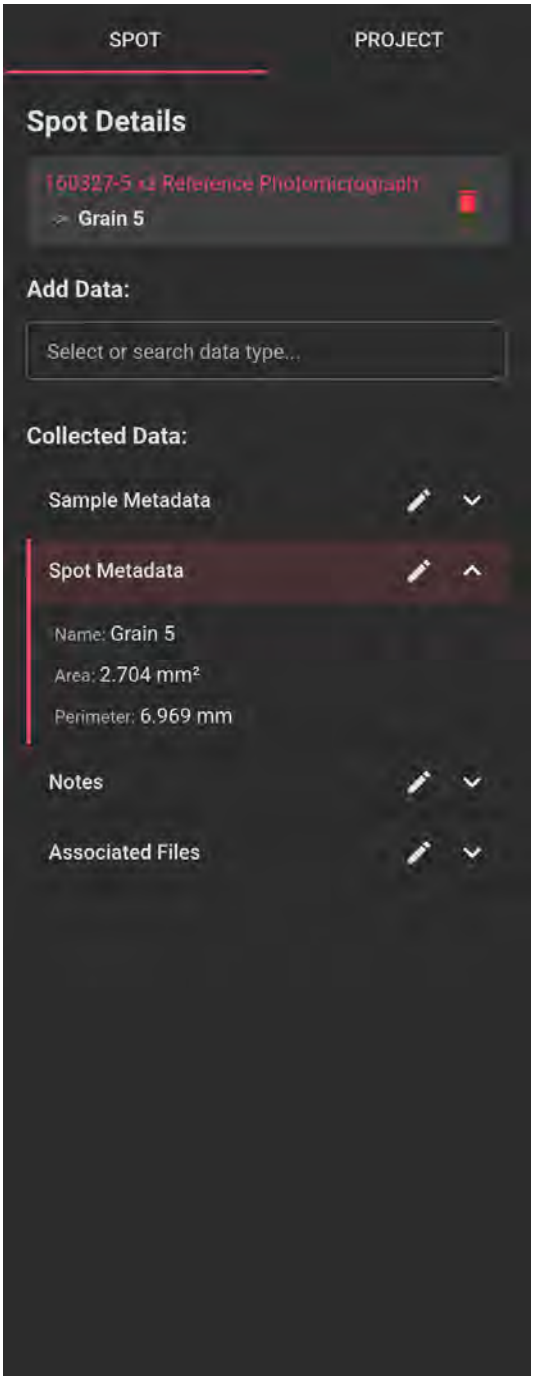


Figure 42. Spot Metadata panel showing selected spot with editable data fields.

Once the micrograph or spot is selected, use the **Add Data:** field in the Metadata Pane ("Select or search data type..."). Click it to choose from the list, or type to search; the search also finds the fields inside each data type (for example, typing "undulose" finds Extinction Microstructures). Click the data type and complete its form. Besides the geological data types below, the list includes **Sample Info** and **Micrograph Info** (for a micrograph) or **Spot Data** (for a spot), which open the sample's, micrograph's or spot's own information.

Data you have entered is listed under **Collected Data**; click the pencil of a section to edit it. In a shared project, you can add data only if your role allows it (Section 9.5.3).

For spots, the **Apply Preset** button applies a Quick Spot Preset, which can add several kinds of data at once (Section 7.4).

6.2 Types of Data

The following subsections provide descriptions and example screenshots for each type of data entry modal available in StraboMicro.

6.2.1 Mineralogy and Lithology

Use this panel to document mineral constituents and lithologic characteristics of the sample.

- **Mineralogy Tab:** Add observed minerals, with an optional **Operator** and **Percentage** for each, how the mineralogy was determined and how percentages were calculated, and notes. (See Figure 44.) Percentages must be between 0 and 100.
- **Lithology Tab:** Describe lithology and add supporting notes. (See Figure 45.)

A mineral or lithology is saved only after you click **Add**, which puts it in the list. If you click **Save** while one is chosen but not added, **Add before saving?** asks what to do: **Back** returns to the dialog, **Save Without It** saves only what is in the list, and **Add and Save** adds it and saves. (**Add and Save** is not available while the percentage is outside 0 to 100.)

Finding a mineral: every mineral field works the same way, here and in Fabrics, point counting, mineral colors and elsewhere. Scrolling shows the 150 common minerals; typing searches all of the more than 5,500 minerals in the list.

Names that are not minerals: to record something that is not in the list, such as lithic fragments or glass, type its name and choose **Use "…"** at the end of the list (Figure 43). It is marked *not in mineral list*, and names already used in the project are offered again when you type.

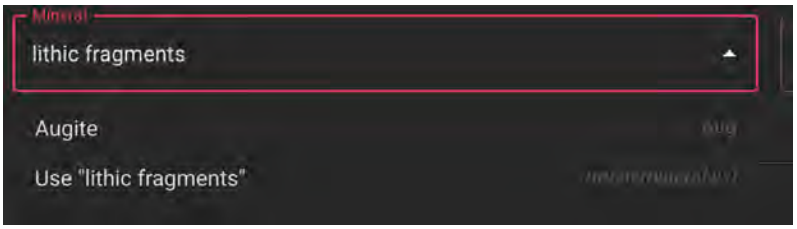


Figure 43. A name that is not in the mineral list, offered as Use "lithic fragments".

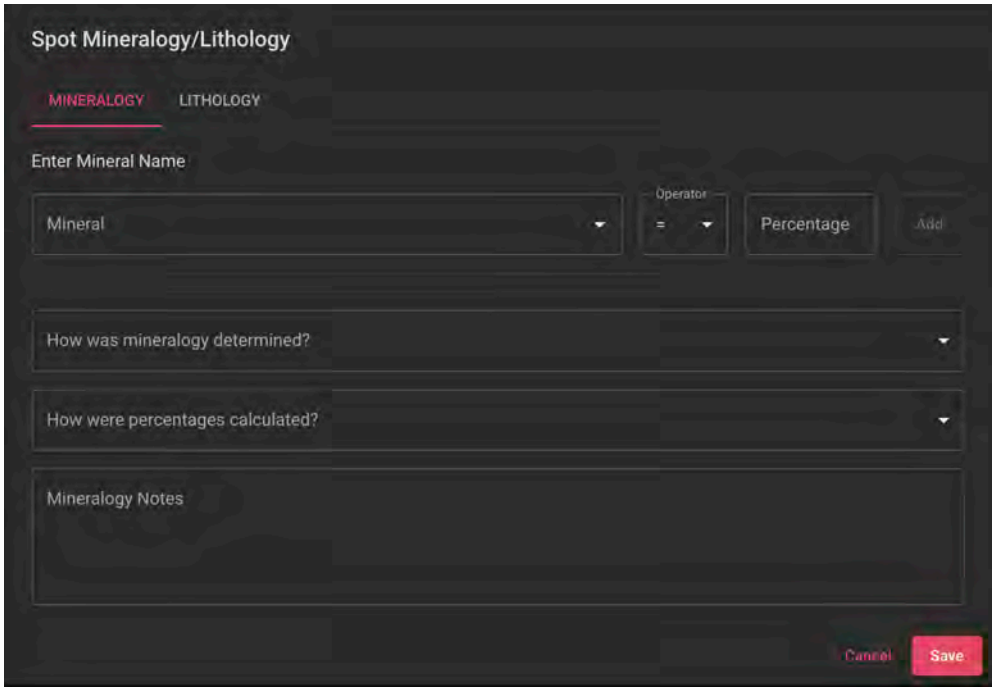


Figure 44. Mineralogy data modal for entering observed minerals.

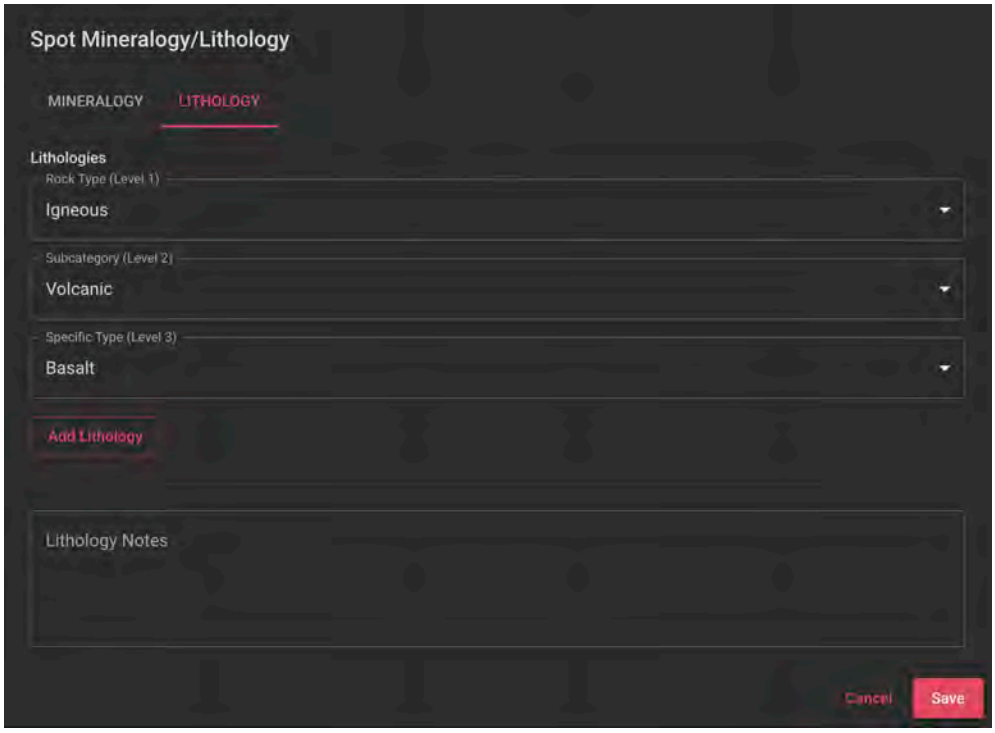


Figure 45. Lithology data modal with fields for rock type and additional notes.

6.2.2 Grain Size, Shape, and SPO

The **Grain Size/Shape/SPO** form has three tabs. Each entry can be linked to a phase from the mineralogy already entered.

- **Grain Size:** Mean, Median, Mode and Standard Deviation, each with a unit. (See Figure 46.)
- **Shape:** observed grain shapes. (See Figure 47.)

- **Orientation:** shape preferred orientation: Mean Orientation (degrees), what it is Relative to, and the Software used. (See Figure 48.)

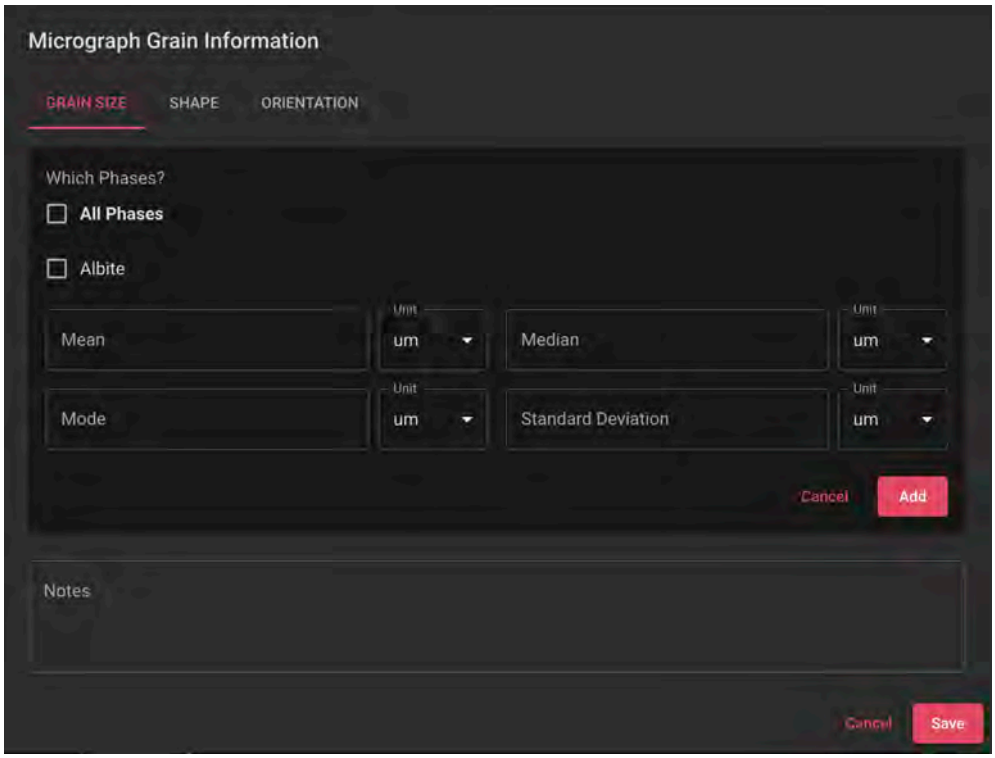


Figure 46. Grain Size data modal with fields for entering quantitative grain size information.

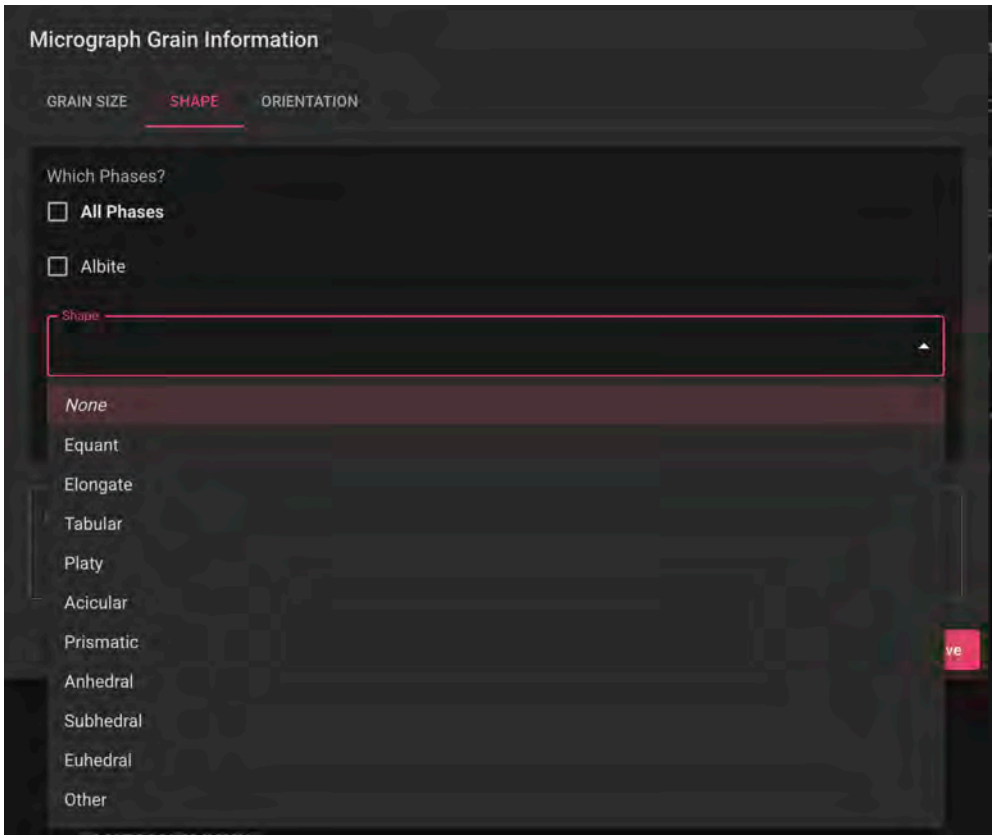


Figure 47. Grain Shape modal showing morphology options.

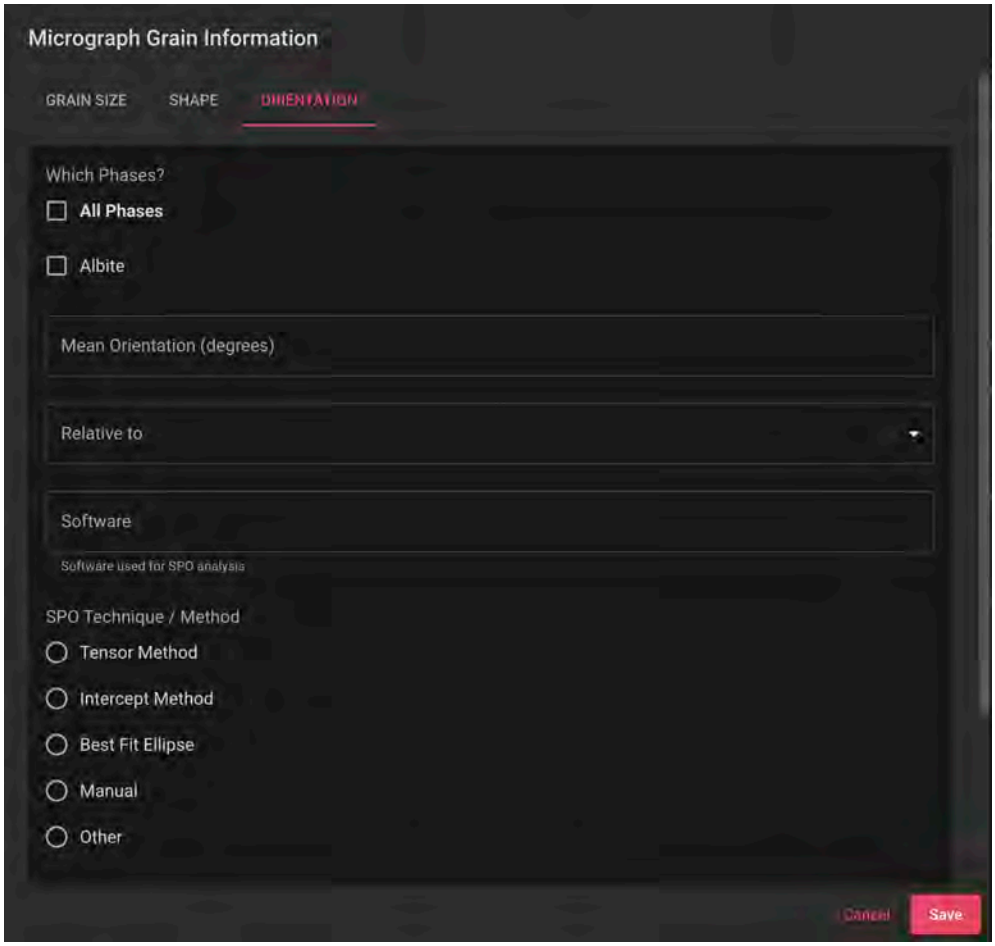


Figure 48. Shape Preferred Orientation (SPO) modal for documenting alignment of grains.

6.2.3 Fabrics

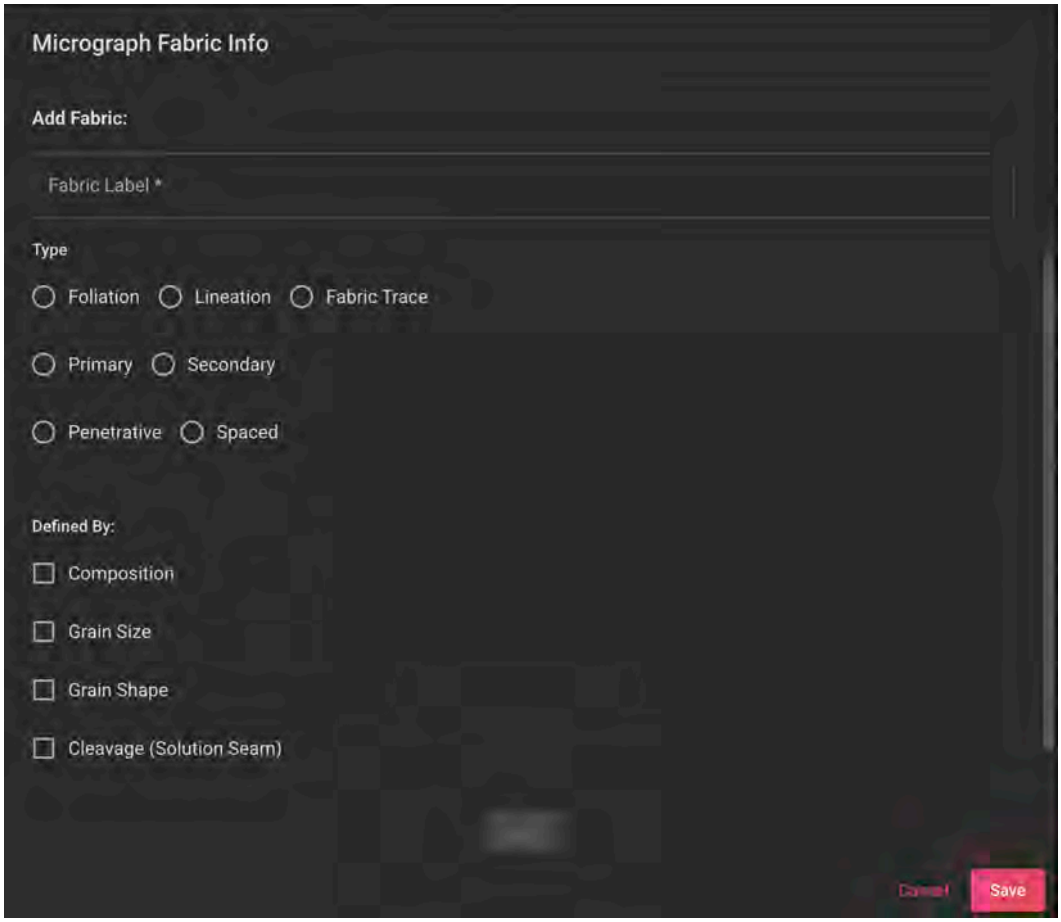
Fabrics can be classified as **foliation**, **lineation**, or **fabric trace**, and further characterized as either **primary** or **secondary**, and **penetrative** or **spaced**.

Each fabric needs a **Fabric Label**. Under **Defined By:**, check one or more of the following (optional); each checked option adds its own fields:

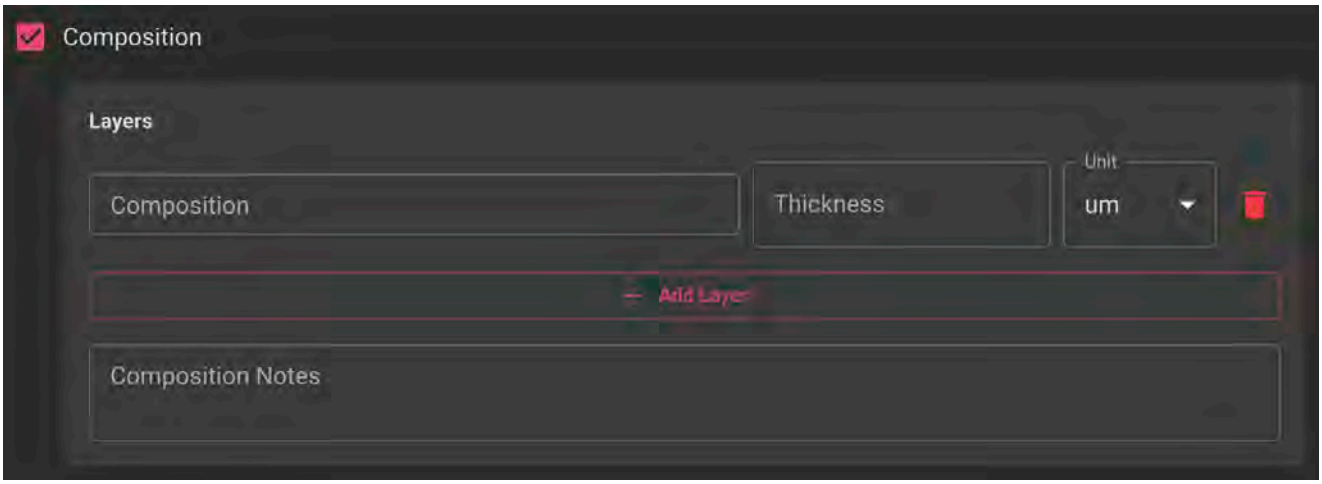
- **Composition**
- **Grain Size**
- **Grain Shape Orientation**
- **Cleavage (Solution Seam)**

The figures below show the fields for each option.

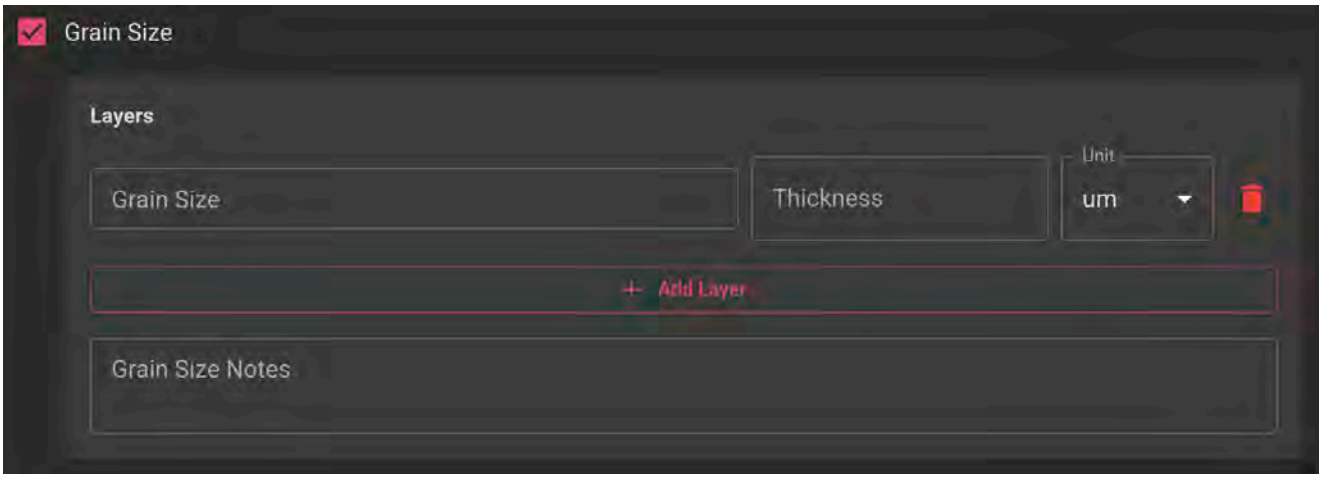
Fabric Data Entry Form



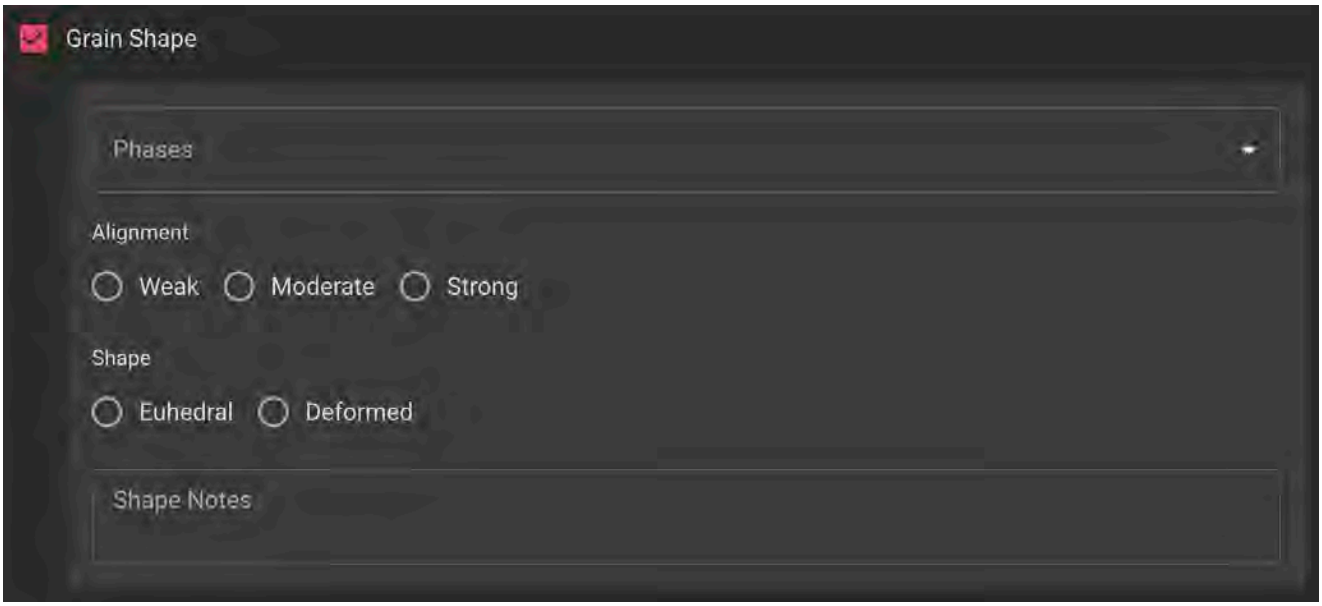
Fabric defined by Composition



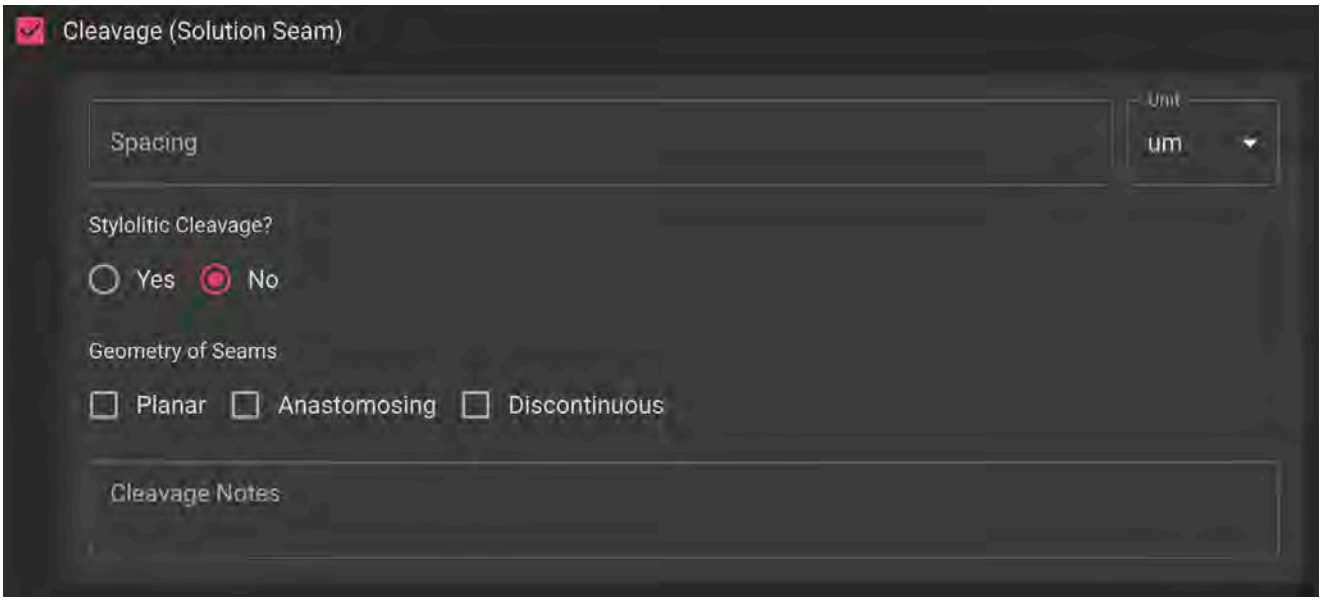
Fabric defined by Grain Size



Fabric defined by Grain Shape



Fabric defined by Clevage



Multiple fabrics may be defined for a single spot or micrograph if needed.

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6.2.4 Clastic Deformation Bands

Clastic deformation bands can be characterized by several properties:

- **Type:** Select one or more of *cataclastic*, *dilation*, *shear*, or *compaction*.
- **Thickness:** Specify the thickness of the band. Dilation bands also have an **Aperture**, and shear bands an **Offset**.
- **Cement Type:** Optionally note the type(s) of cement present.

These input fields appear in the clastic deformation band data modal.

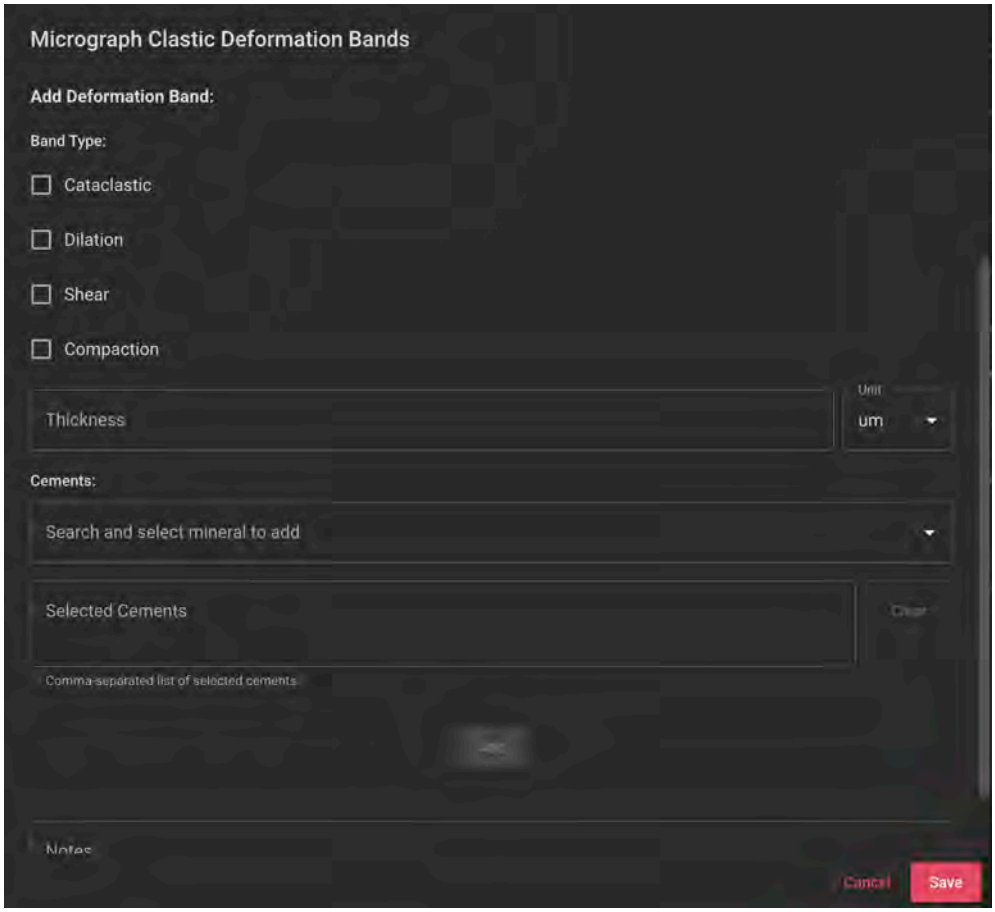


Figure 49. Data entry modal for clastic deformation bands

6.2.5 Grain Boundaries and Contacts

First choose whether the observation is a **Phase Boundary** or a **Grain Boundary**. All grain boundary and grain contact observations can be linked to previously defined mineralogy or lithology for the selected image or spot, improving contextual understanding and interpretive accuracy. A variety of grain boundary morphologies may be selected using check boxes; multiple selections are allowed. Boundary descriptors can be further refined using additional criteria based on the initial selection.

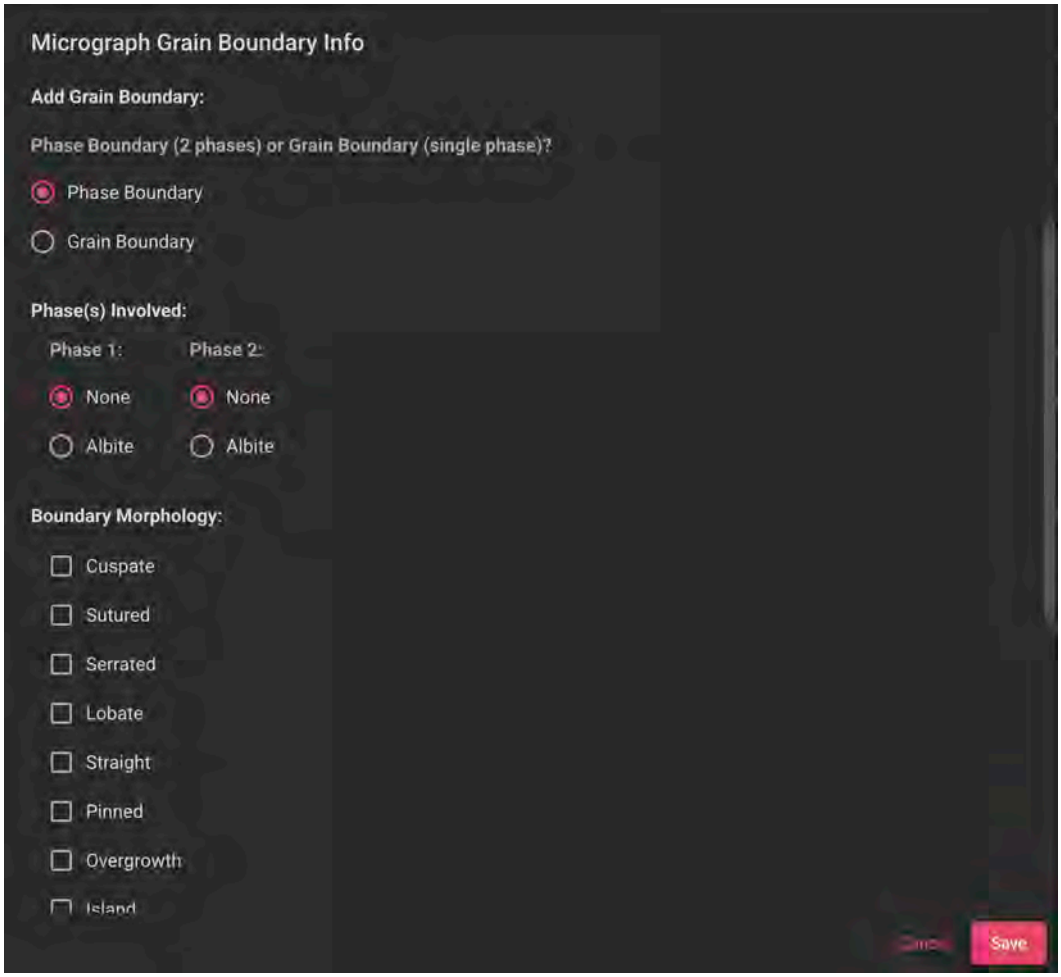


Figure 50. User interface options for grain boundary characterization, including point and line spot tools, mineralogical associations, and descriptor check boxes.

6.2.6 Intragranular Structures

Intragranular structures are features that occur within individual mineral grains. When documenting these structures, users can specify the associated mineral by selecting from the previously defined mineralogy or lithology list.

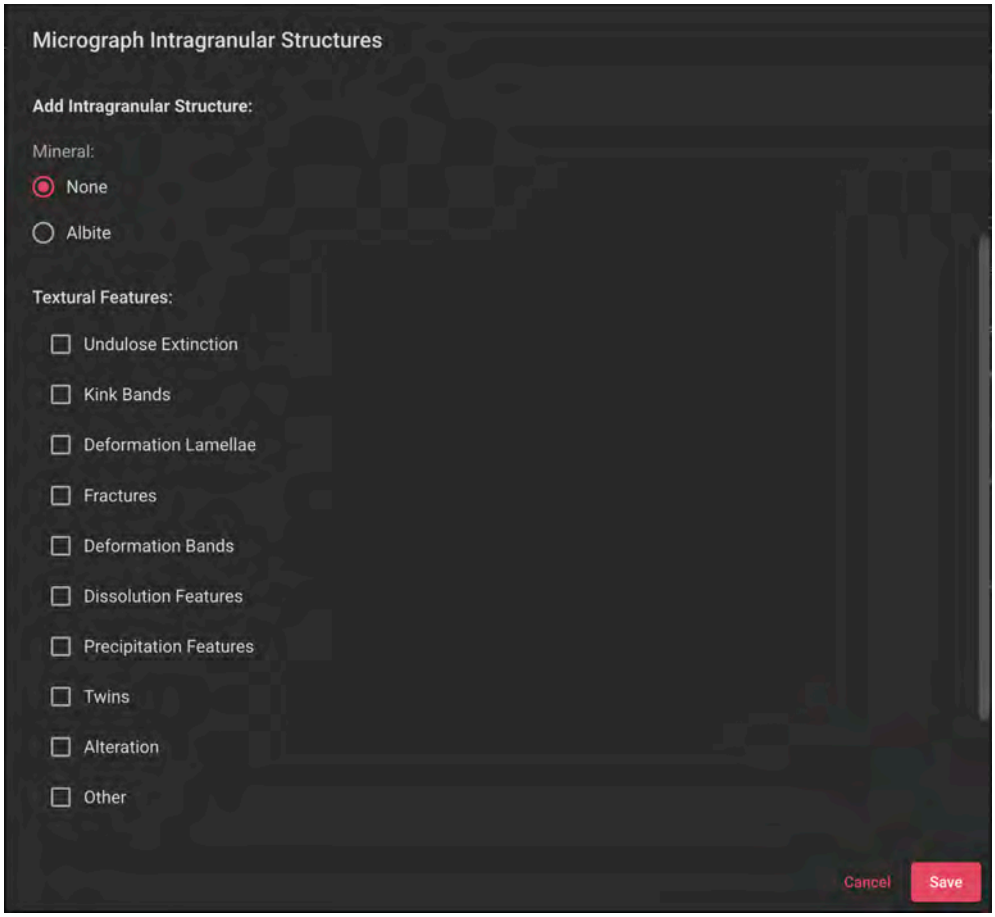


Figure 51. Interface for adding Intragranular structures, showing the option to associate each feature with a defined mineral.

6.2.7 Veins

Observational data related to veins within a thin section can be entered directly within this form. Unlike other features, vein mineralogy is defined here and does not need to be selected from the previously defined mineralogy or lithology list.

Users can document various characteristics of veins, including crystal shape, growth morphology, inclusion trails, kinematic indicators, and any additional relevant notes. This allows for detailed description of vein textures and formation processes.

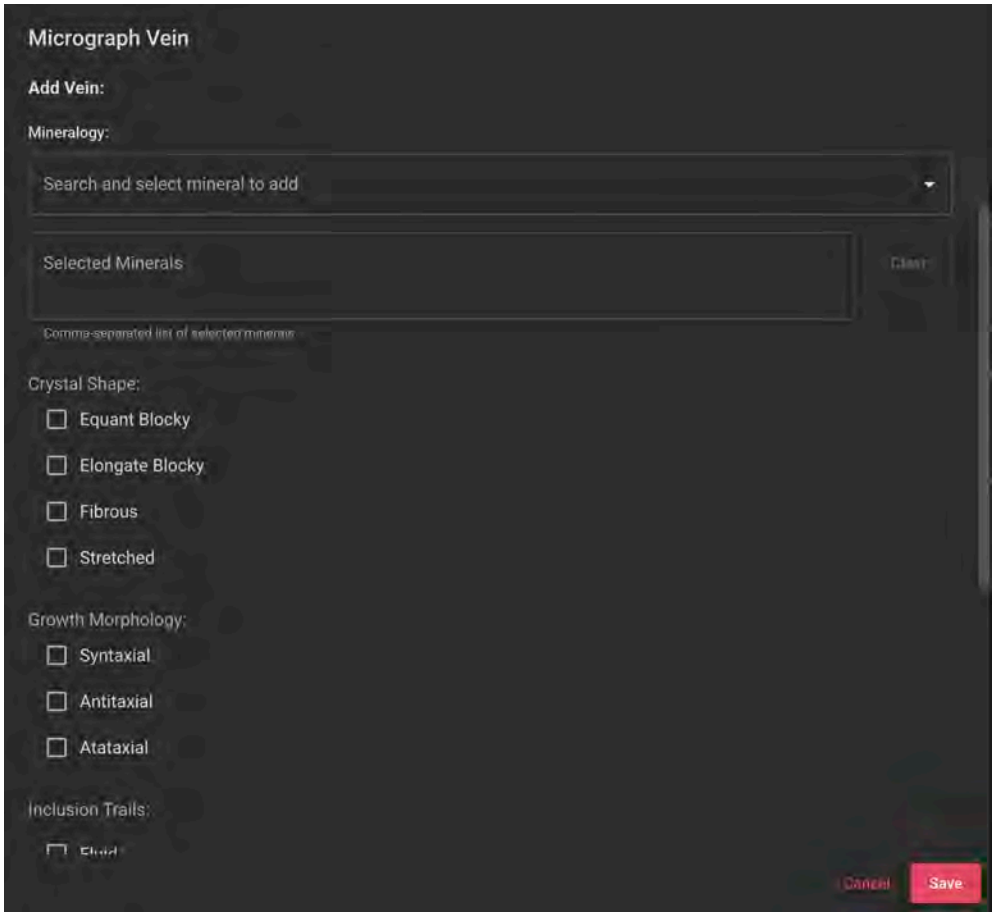


Figure 52. Interface for entering vein-related observations, including mineralogy, morphology, and kinematic features.

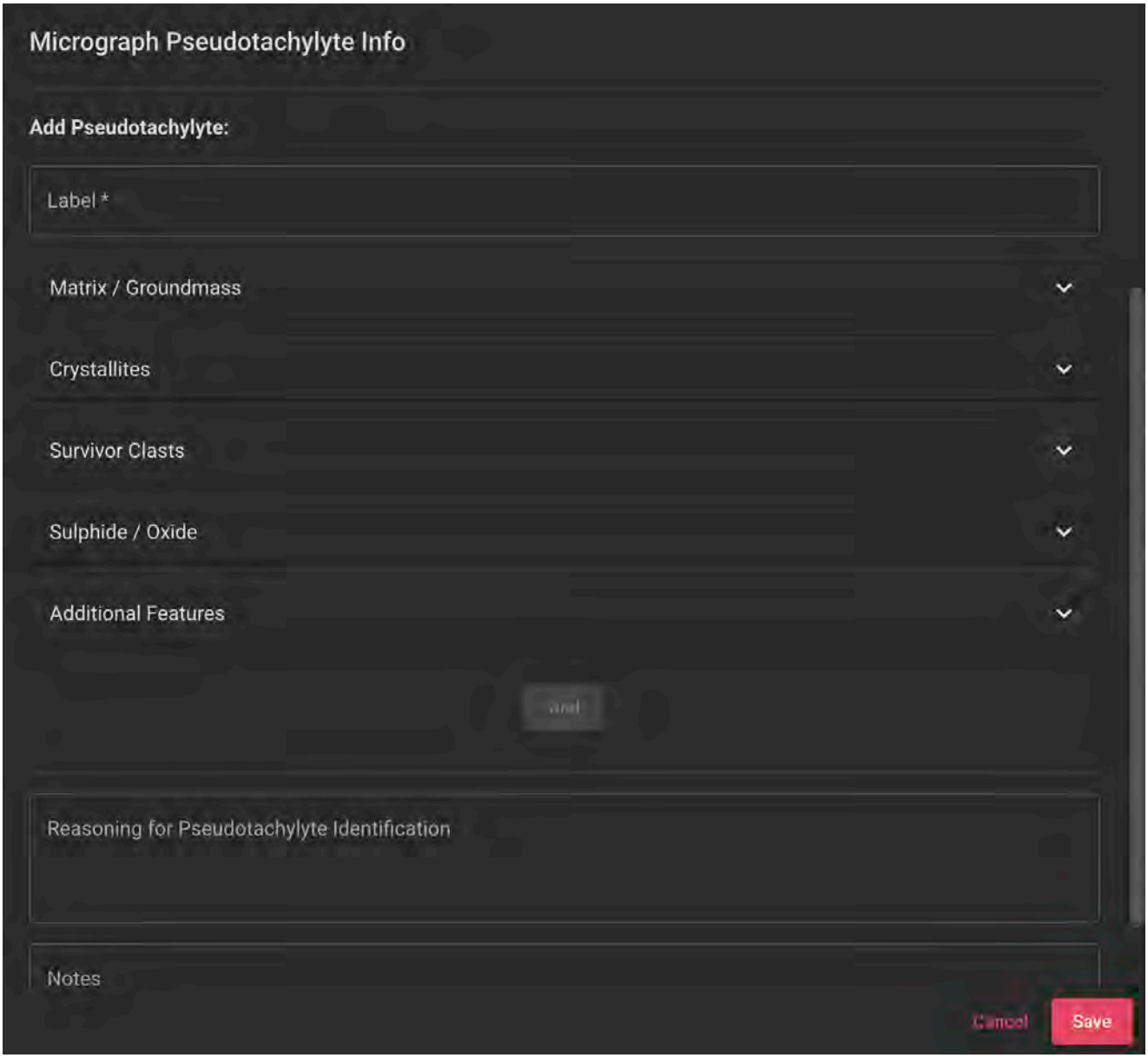
6.2.8 Pseudotachylyte

Pseudotachylyte data entry can be further refined by selecting from a set of observed features. These options allow for detailed characterization of textures and components associated with pseudotachylyte formation.

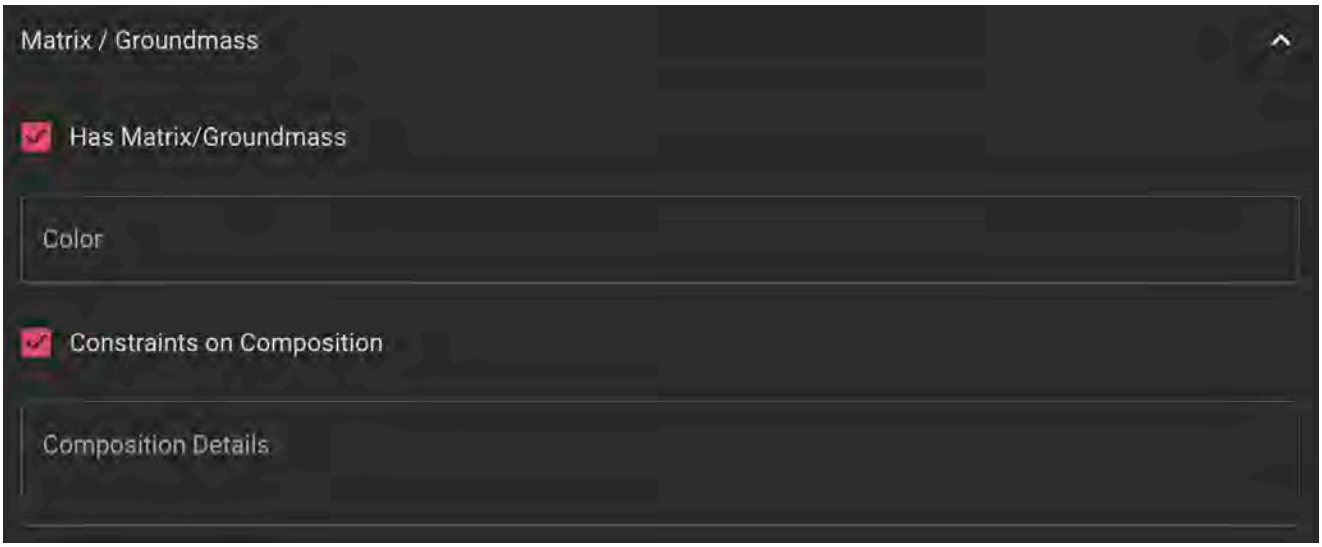
The figures below display all available metadata input options. The first figure shows the primary metadata modal, followed by individual conditional fields that appear based on the selected feature. Observed features include:

- Matrix / groundmass
- (Micro)crystallites
- Survivor clasts
- Sulphide / oxide droplets
- Fabric
- Injection features
- Chilled margins
- Vesicles / amygdules

Main Metadata Modal



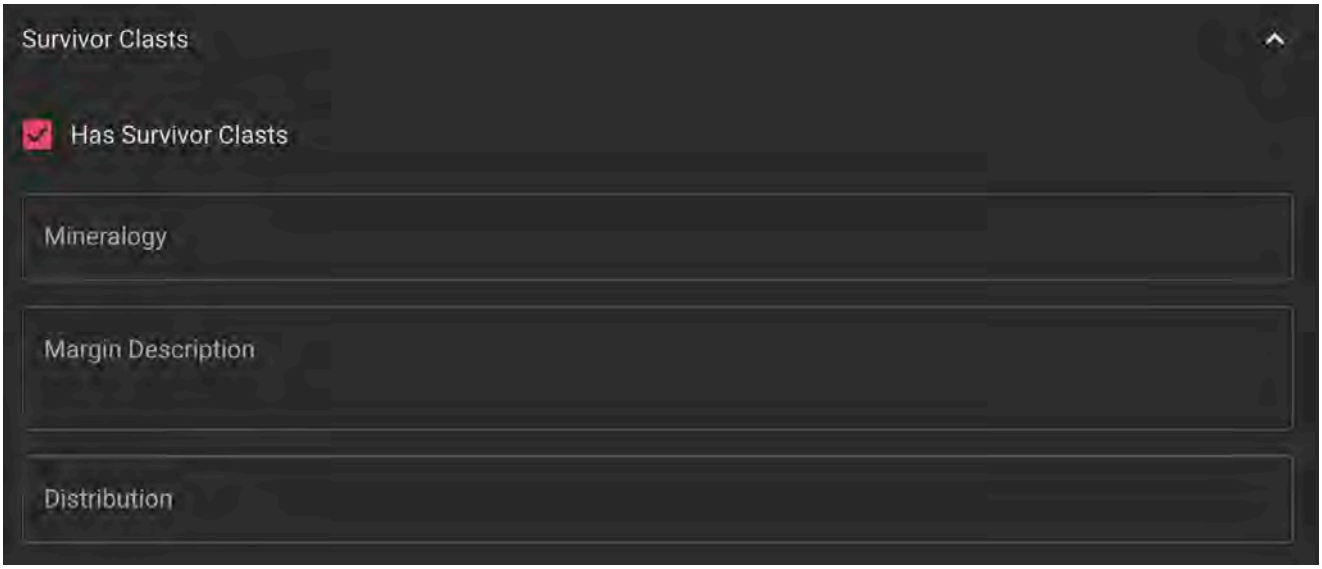
Matrix / Groundmass



(Micro) Crystallites



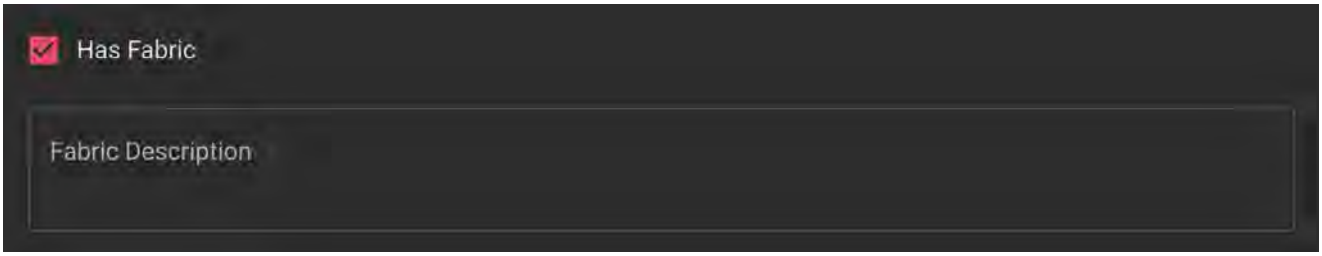
Survivor Clasts



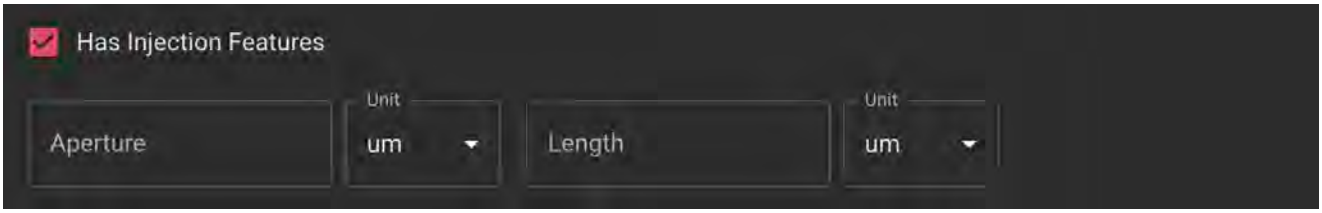
Sulphide / Oxide Droplets



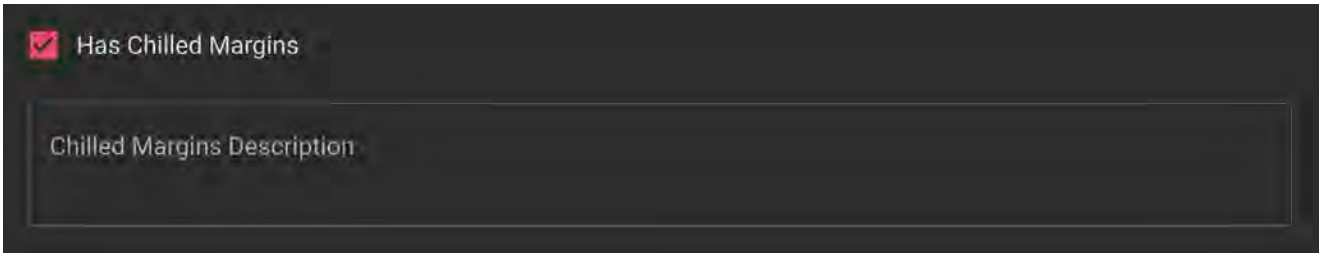
Fabric



Injection Features



Chilled Margins



Vesicles / Amygdules



Figure 53. Pseudotachylyte metadata entry options. Each screenshot shows the available fields for a specific observed feature when selected in the form interface.

6.2.9 Folds

The **Folds Modal** provides a structured approach for describing key characteristics of folds. Users can specify attributes such as:

- Custom labels
- Interlimb angle geometry
- Closure geometry
- Axial trace orientation
- Amplitude, wavelength and vergence
- Symmetry
- Fold style
- Continuity
- Facing direction
- Additional notes

This allows for consistent and comprehensive documentation of fold structures at the micro-graph or spot level.

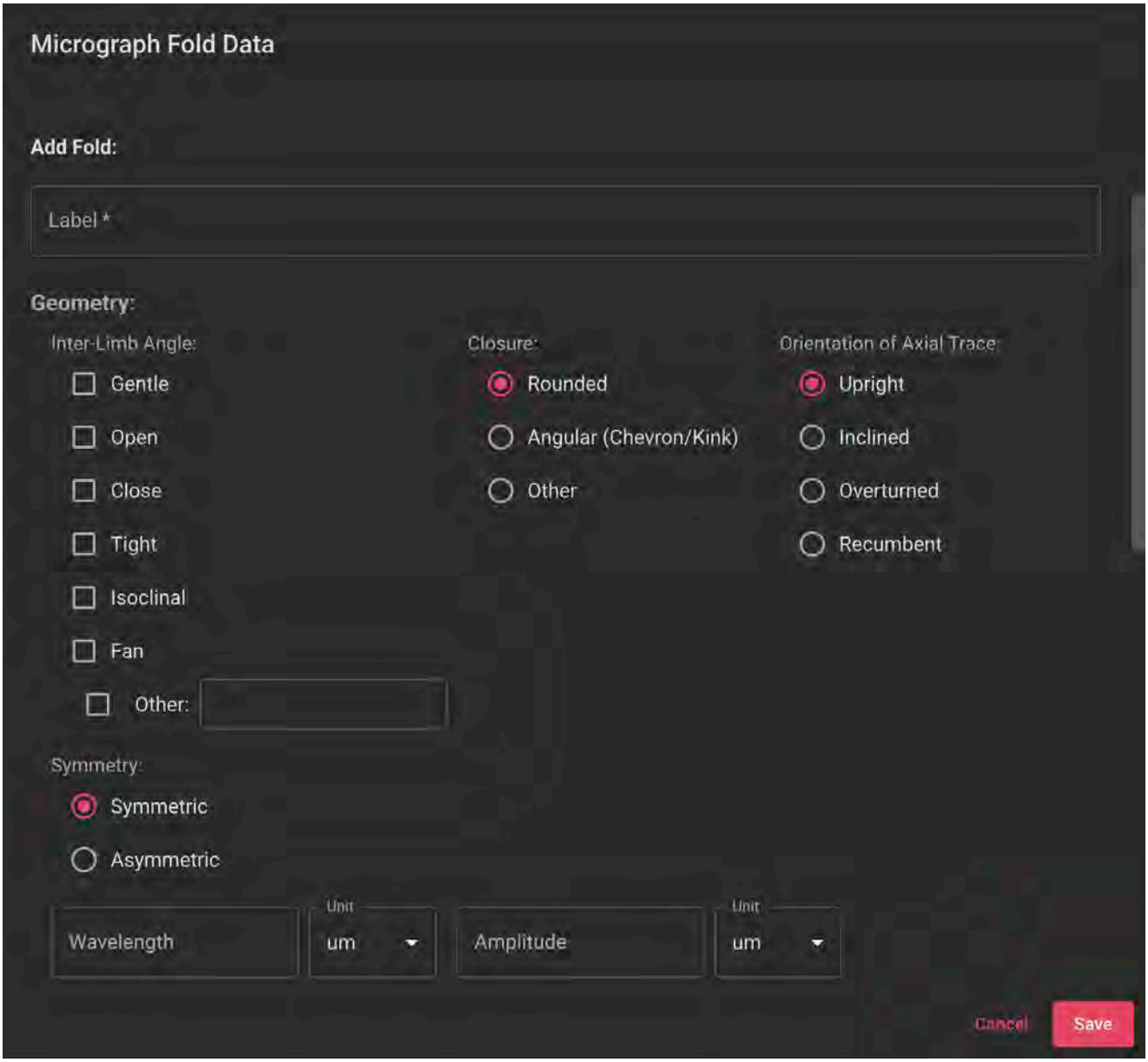


Figure 54. Fold Modal: Fold Geometry

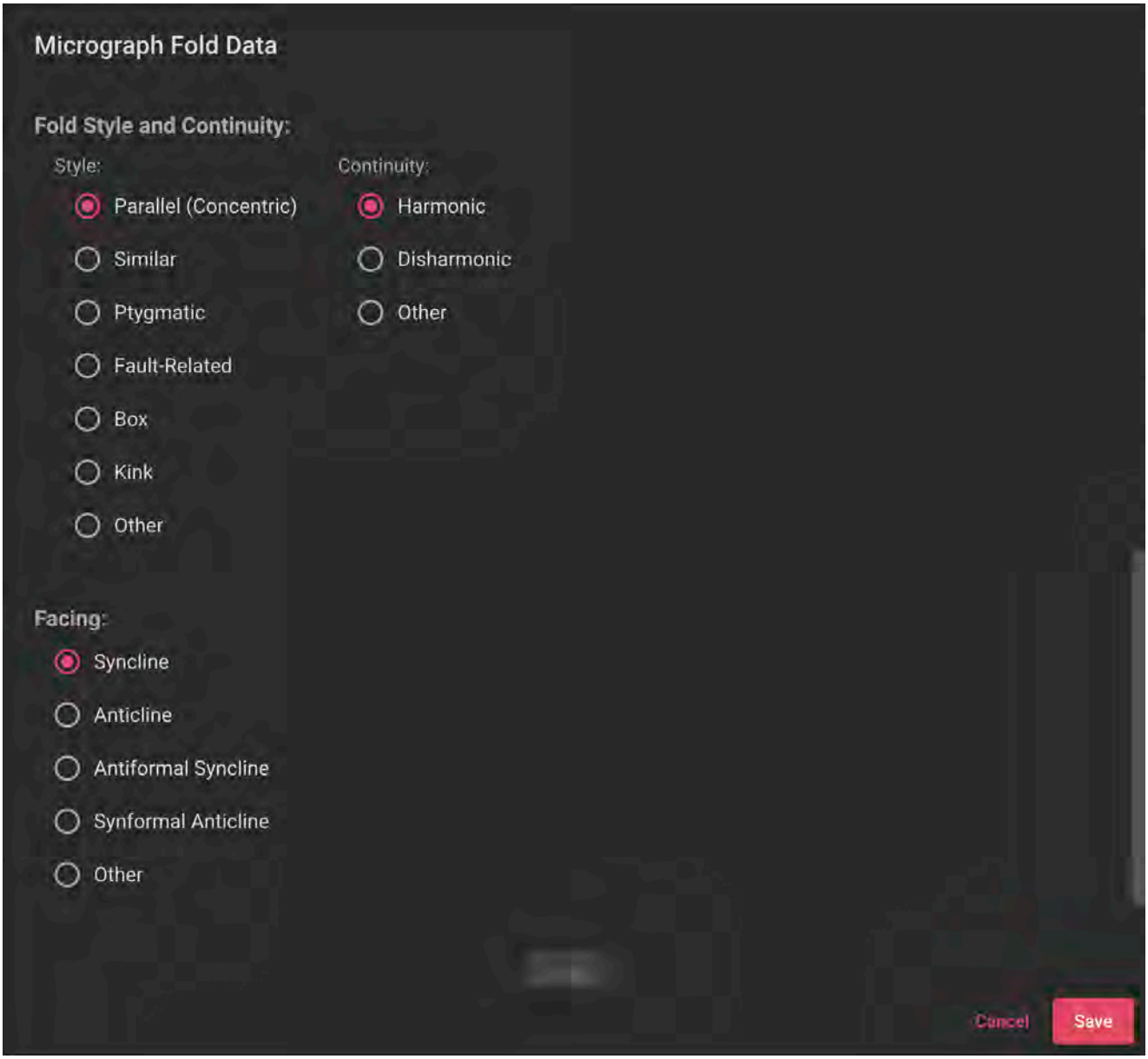


Figure 55. Fold Modal: Fold Style and Continuity

6.2.10 Faults and Shear Zones

The **Faults and Shear Zones** modal allows users to input structural data directly onto micrographs or spatial points (spots). Users can define shear sense and specify associated shear sense indicators. Additional metadata such as measured offsets and zone widths can be recorded, along with any relevant observations entered into the freeform notes field.

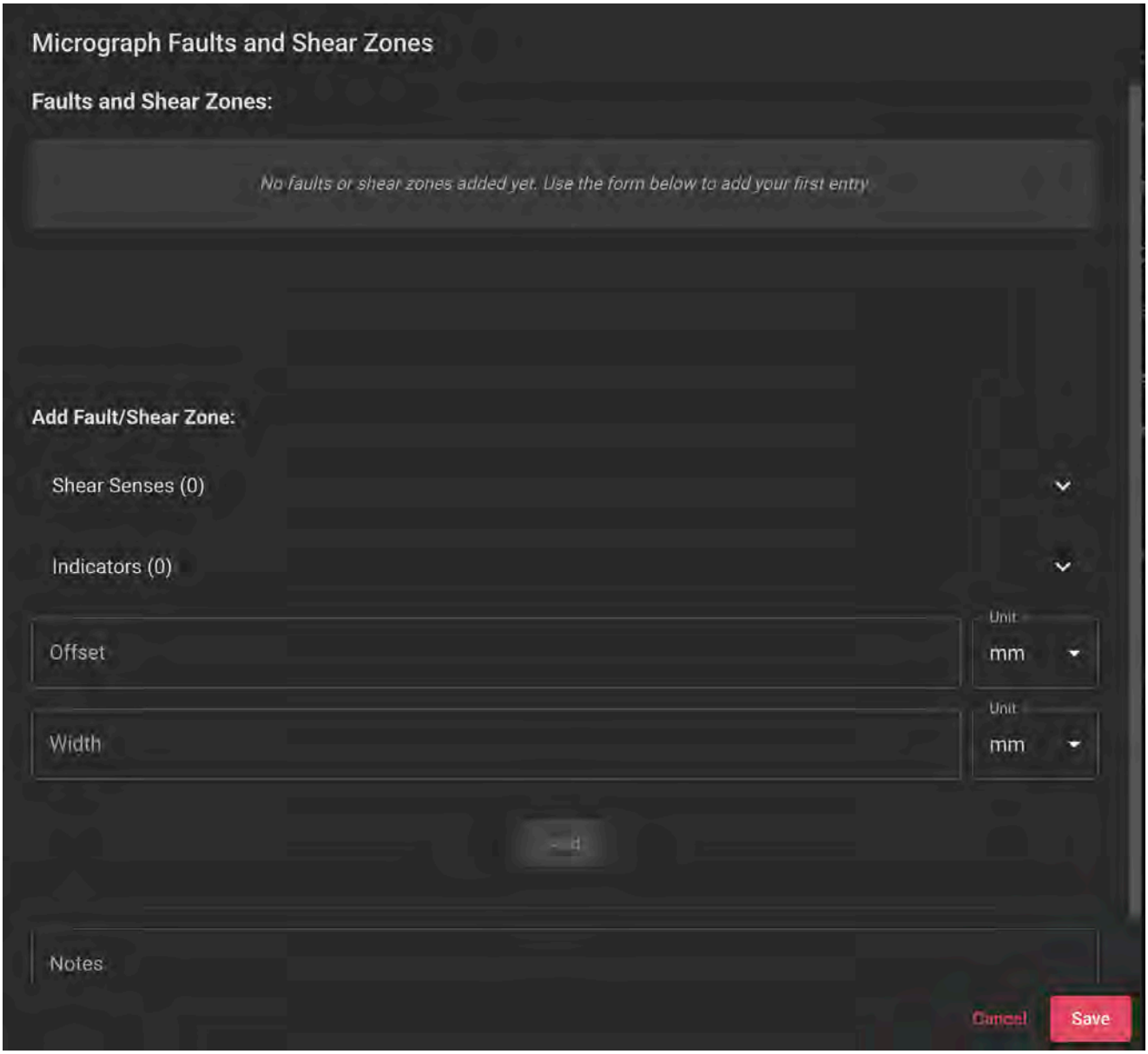


Figure 56. Screenshot of the *Faults and Shear Zones* data input modal.

6.2.11 Extinction Microstructures

Extinction microstructure metadata can be added to a micrograph or spot and includes attributes such as the mineral phase, type of heterogeneous extinction, presence of subgrain structures, extinction bands, and dislocations.

Multiple microstructures can be recorded in this section. For example, if a sample exhibits chessboard extinction in quartz and patchy, undulose extinction in feldspar, both structures can be documented as separate entries within the metadata.

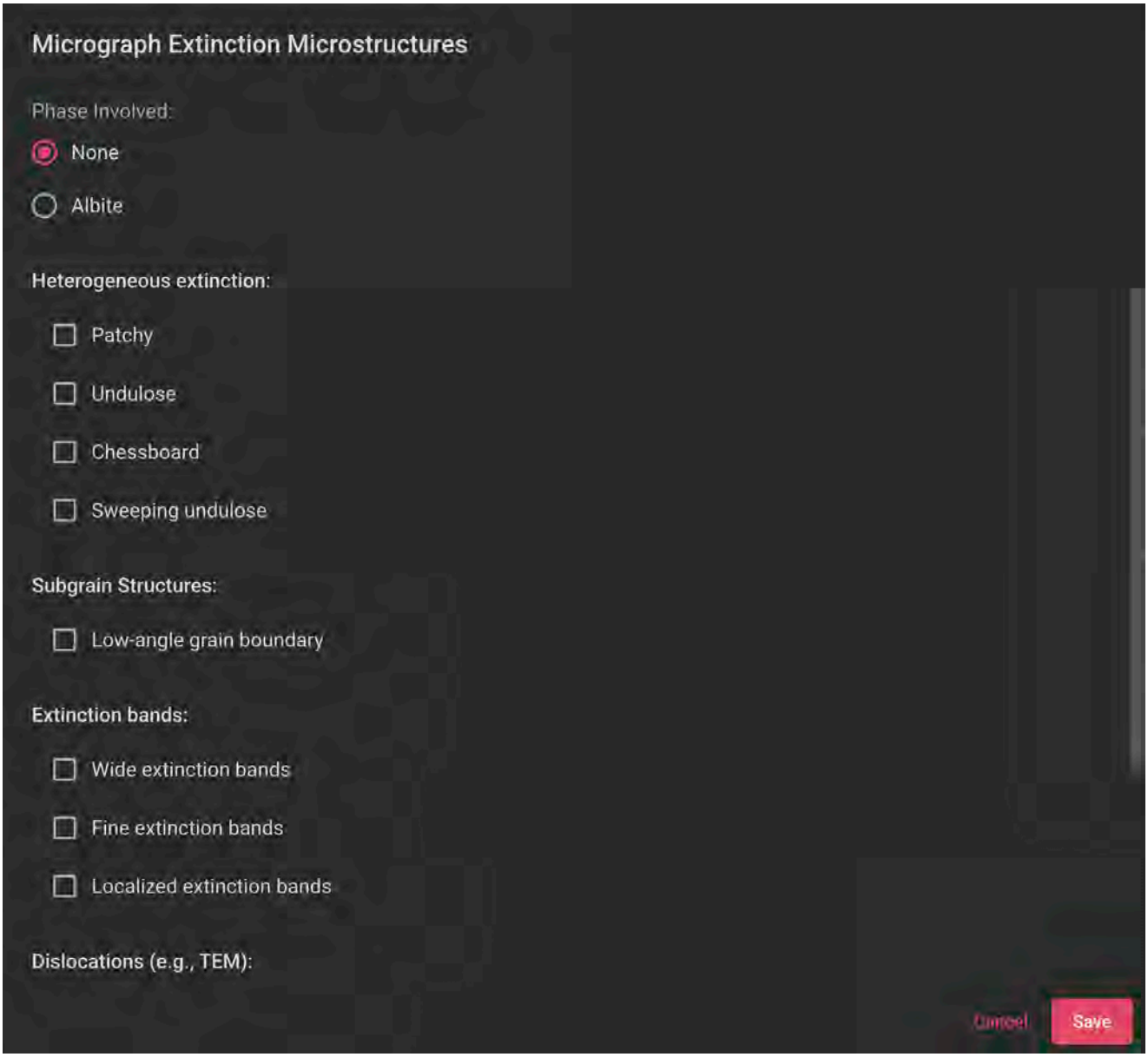


Figure 57. Screenshot of the *Extinction Microstructures* data input modal.

6.2.12 Fractures

Fractures can be recorded on a micrograph or spot using the **Fractures** modal. The mineralogy of fractured phases does not need to be predefined; relevant minerals can be specified within the form itself. Users can also record whether the fracture is **Intragranular / Single Crystal** or **Multigranular**, define the kinematic mode, input measured aperture or offset values (with units), and indicate whether the fracture is sealed or healed using a checkbox. A freeform notes field is available for additional observations.

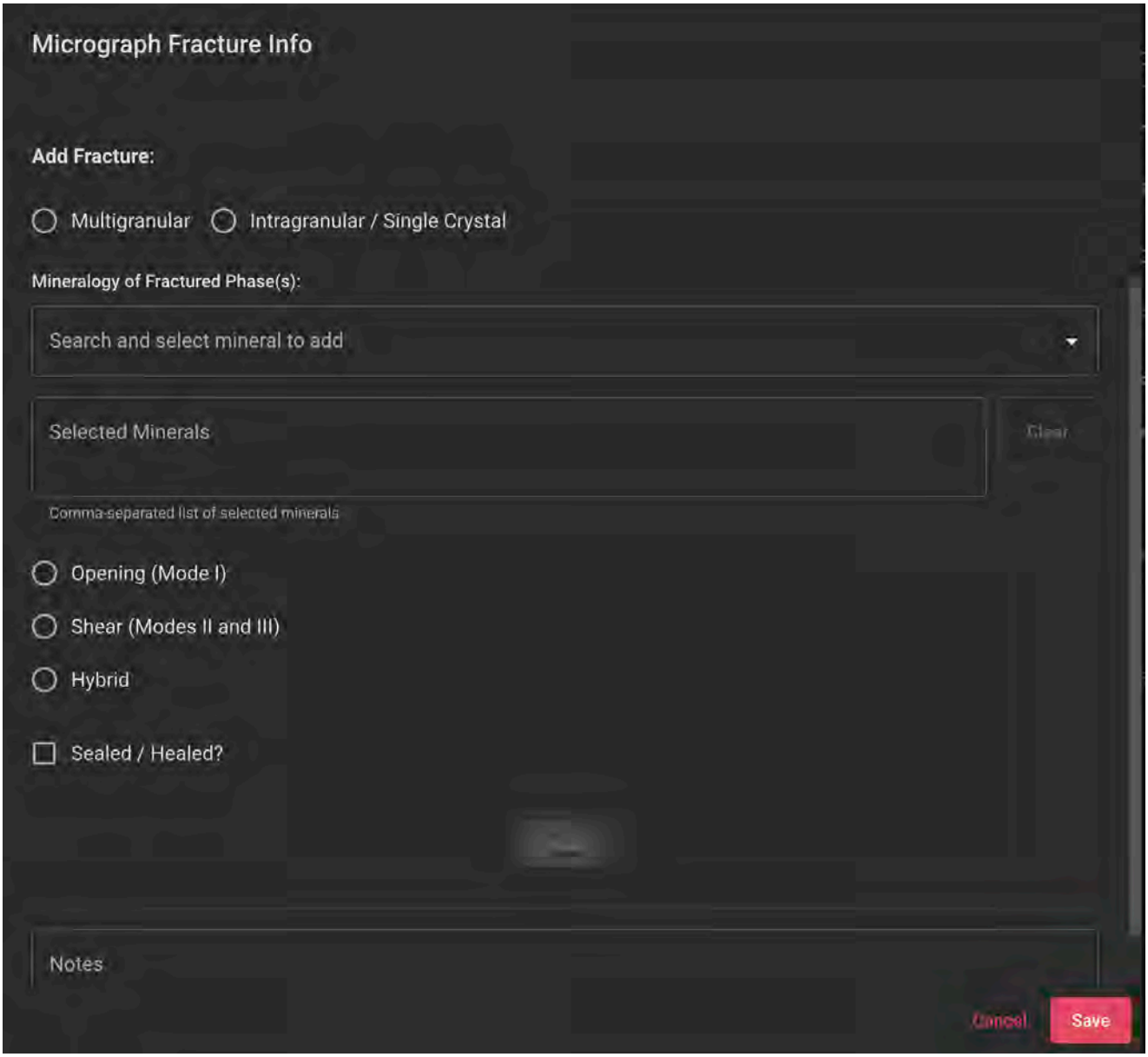


Figure 58. Screenshot of the *Fractures* data input modal.

6.2.13 Notes

The **Notes** field provides a freeform text area for entering and editing descriptive or contextual information. This section supports extended text and is ideal for capturing observations, interpretations, or any additional metadata that may not fit into predefined fields.



Figure 59. Screenshot of the *Notes* text entry modal using the Add Data funtion in the metadata pane.

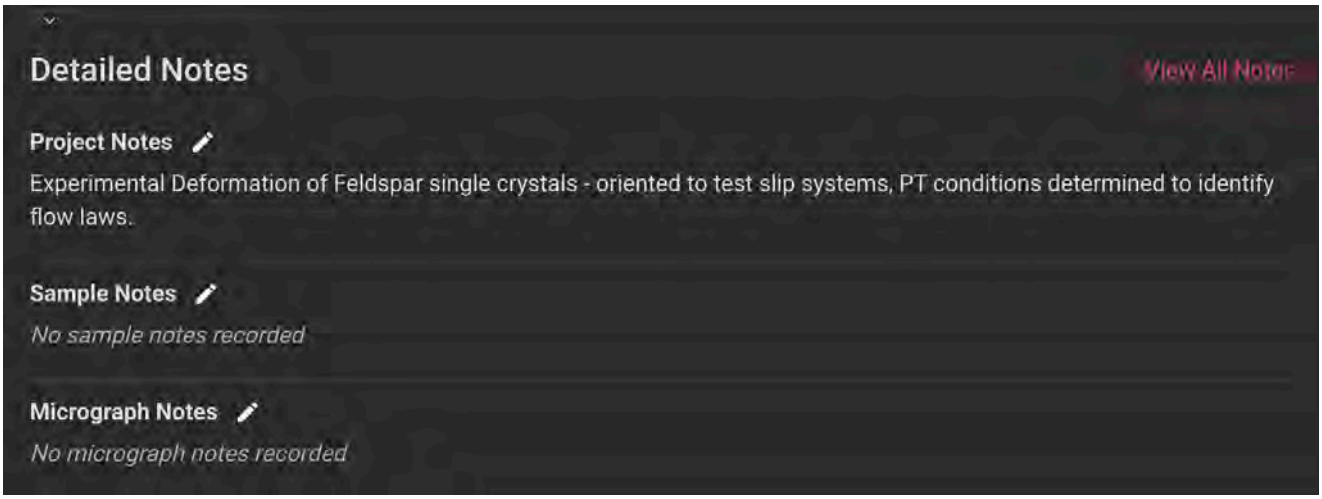


Figure 60. Screenshot of the *Notes* text entry field under the micrograph view.

6.2.14 Associated Files

Users can attach external files to a micrograph or spot using the **Associated Files** modal. Files can be added individually or in bulk by selecting multiple files at once.

Single File Import To add a single file, select the file type (Image, Spreadsheet, PDF, Script or Other) from the dropdown menu (Figure 61), and an optional note can be attached. Notes are linked to the currently selected file and will reset after each upload to ensure clear association.

Adding Several Files at Once You can add several files in one step:

- **Multi-select files:** Use `Cmd+click` (macOS) or `Ctrl+click` (Windows/Linux) in the file picker to select multiple files at once.
- **Preview selected files:** Selected files appear as removable chips in the dialog, allowing you to review and remove individual files before import (see Figure 62).

- **Shared metadata:** one **File Type (for all files)** and **Notes (added to each file)** apply to all the selected files.
- Click **Add *N* Files**. The button shows “Adding...” while the files are copied into the project.

Opening Files Associated file names are links that open the file in your computer’s default application:

- **Visual indicator:** A small external link icon appears next to clickable file names to indicate they can be opened.
- **Associated Files dialog:** file names in the list are links.
- **Accordion summary:** File names displayed in the collapsed accordion view are also clickable for quick access.
- **System integration:** Clicking a file name launches the appropriate application based on file type (e.g., PDFs open in Preview or Adobe Reader, images open in the default image viewer).

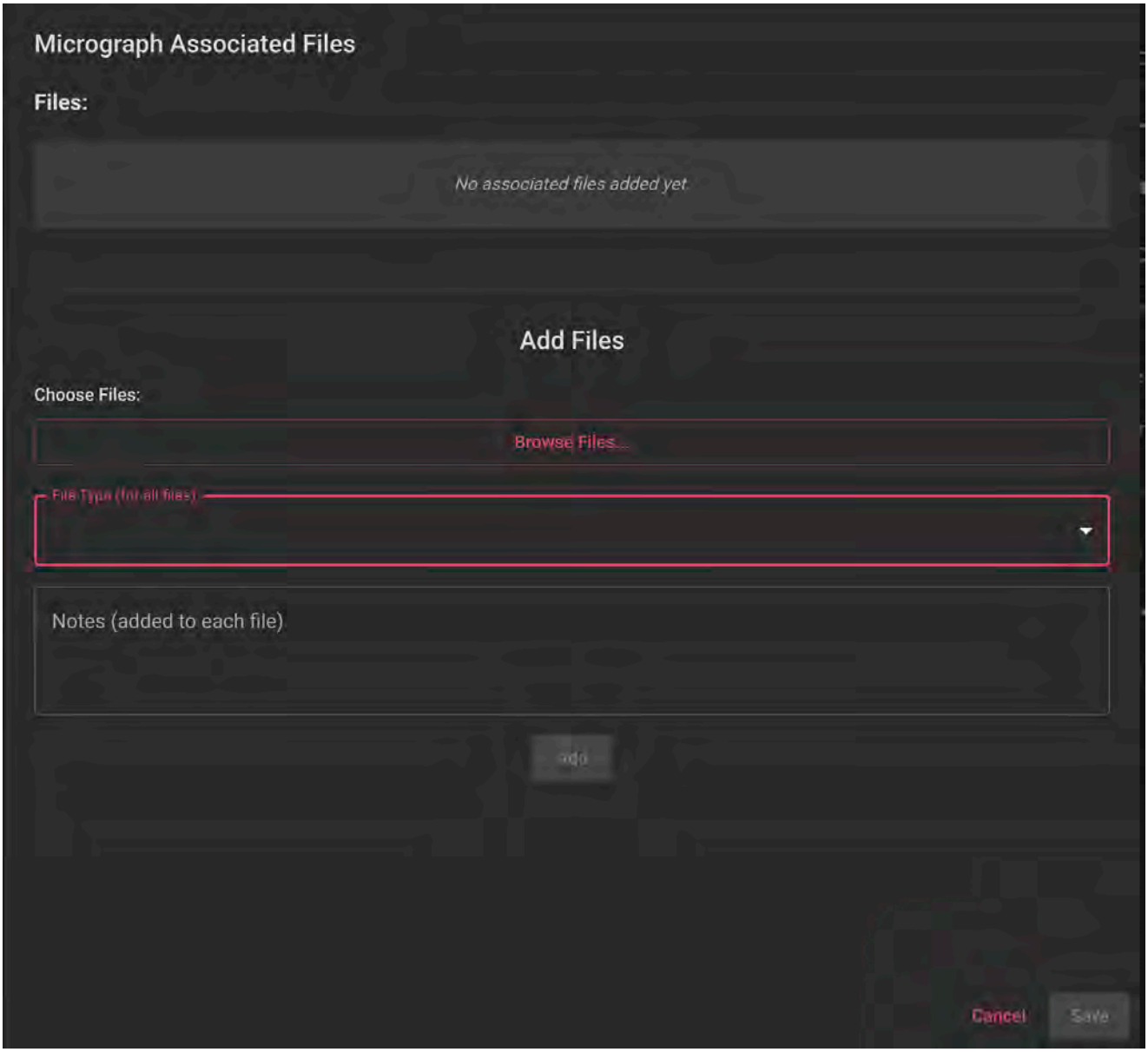


Figure 61. Screenshot of the *Associated Files* modal, showing file selection and type dropdown.

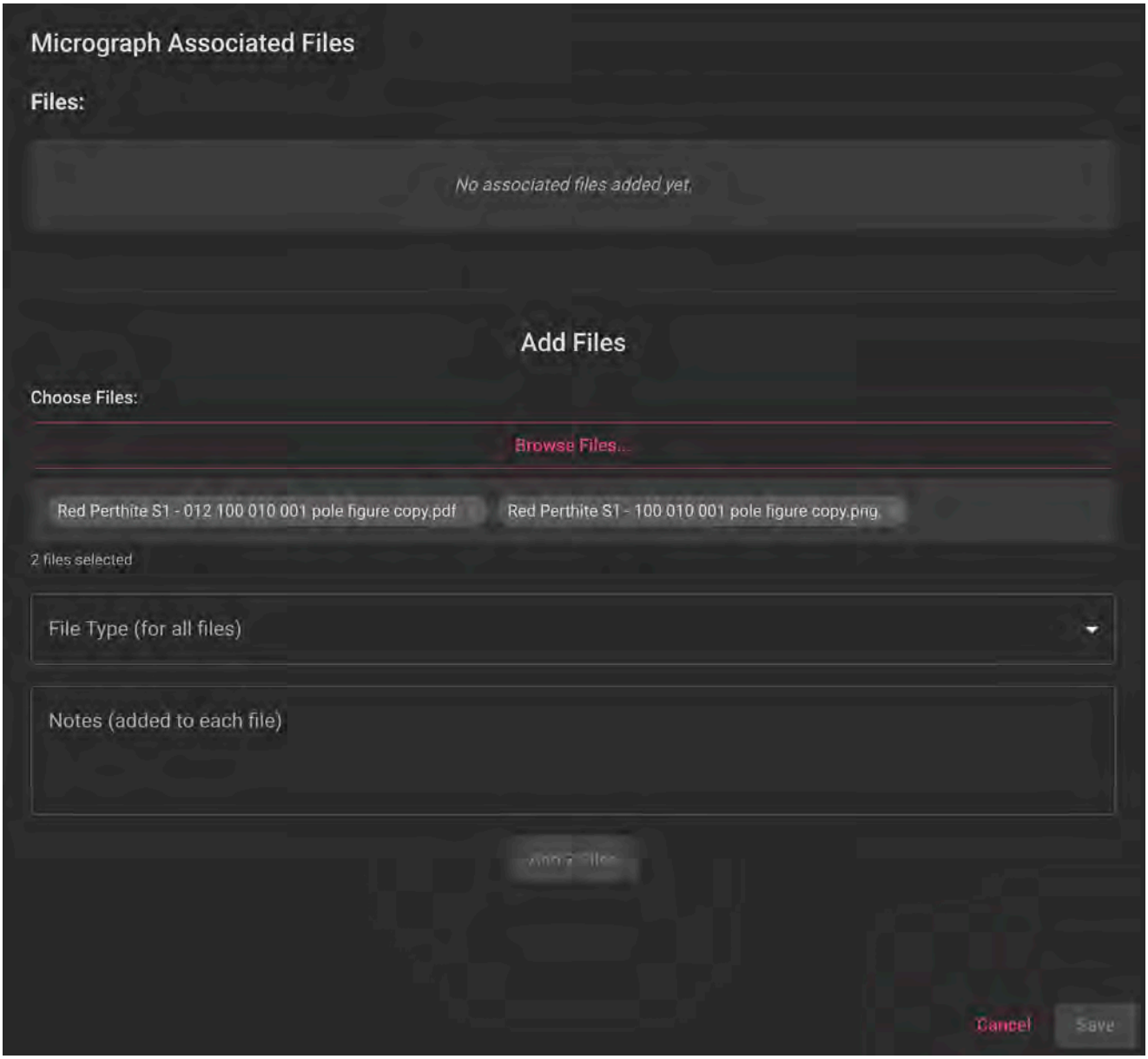


Figure 62. Bulk import interface showing multiple selected files as removable chips with shared metadata fields.

6.2.15 Links

The **Links** section allows users to add one or more external or internal references. Multiple links can be added as needed to connect relevant documents, datasets, or resources.

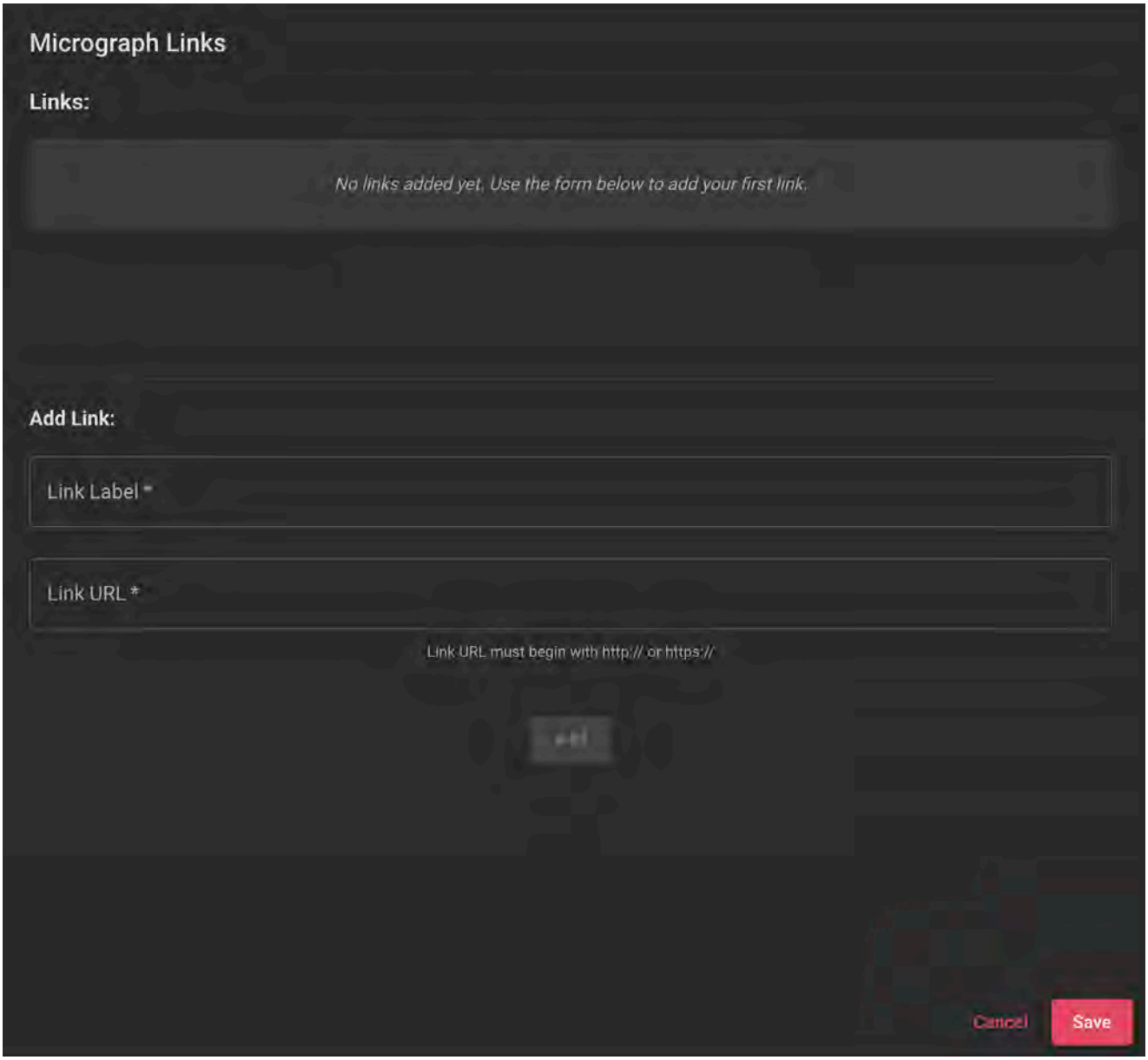


Figure 63. Screenshot of the *Links* data entry interface.

7 Advanced Tools

StraboMicro includes a set of analytical tools for petrographic work: point counting, automated grain detection (classical computer vision or an AI model), rapid spot classification, reusable spot presets, grain size and shape analysis, side-by-side image comparison, stitching overlapping images into one mosaic, and the StraboTools image analyses. This section describes each tool.

Most tools work on the micrograph that is open in the Micrograph Viewer. If no micrograph is selected, StraboMicro asks you to select one first.

7.1 Point Count

Point counting determines the modal composition of a rock by classifying the mineral under each point of a grid. Open the tool with `Tools > Point Count...`.

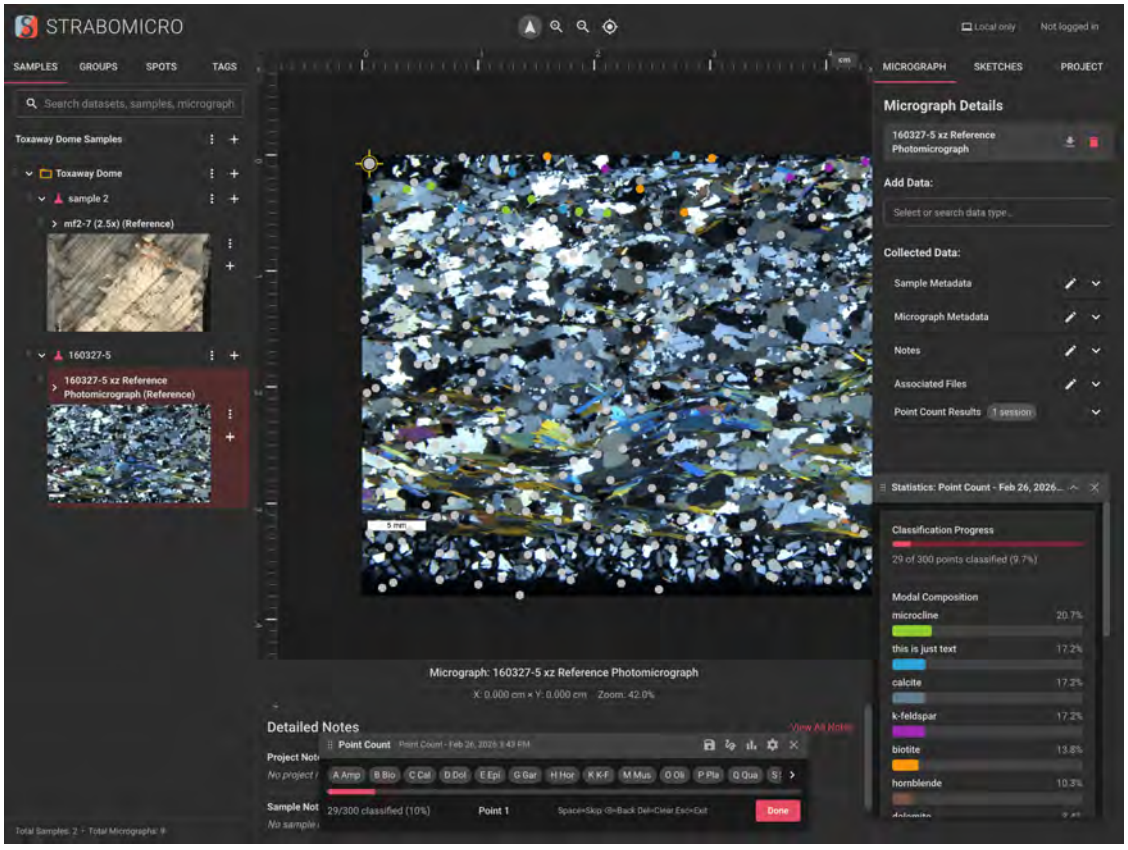


Figure 64. Point counting: the current point (gold crosshair), classified points in their mineral colors, the Point Count toolbar and the statistics panel.

7.1.1 Starting a Session

The first time you open Point Count on a micrograph, the **Point Count** dialog sets up a new session:

- **Session Name:** defaults to the date and time, for example “Point Count - Oct 13, 2026 3:05 PM”.

- **Grid Type:**
  - **Regular:** points on an even grid (offset by half a spacing from the image edges).
  - **Random:** points placed at random across the image.
  - **Stratified Random:** one random point in each cell of a grid, which spreads random points evenly.
- **Recommended Points:** a reminder of common counts (300, 400, 500 points) and the confidence they give.
- **Point Count:** a slider from 100 to 1000 points (default 400). Below it, the resulting grid is shown as rows by columns and the spacing in pixels.
- **Preview:** shows the points on the micrograph before you start (scroll to zoom, drag to pan).

Click **Generate *N* Points** to start counting.

When the micrograph already has sessions, the dialog offers **Continue** on the most recent session, **Start New Session**, and **Choose Other Session...** (when there is more than one). Sessions can be renamed and deleted from their cards.

7.1.2 Counting

Counting happens in the floating **Point Count** toolbar, which you can drag anywhere over the viewer. It shows the session name, the mineral keys, a progress bar ("*x*/*y* classified"), the current point and its mineral, and buttons for **Save Session**, **Lasso Select Multiple Points**, **Statistics**, **Configure Shortcuts**, **Close (Esc)** and **Done**. The current point is marked with a gold crosshair; classified points are filled with their mineral's color. The view pans automatically when the current point nears the edge of the window.

Key	Action
Mineral key (for example `Q`)	Classify the current point and go to the next unclassified point
`Space` or `Enter`	Next point (in grid order), without classifying
`Tab`	Next unclassified point
`Backspace`	Previous point
Arrow keys	Move through the grid by row and column
`Delete`	Clear the current point's classification
`Esc`	Clear the lasso selection; otherwise save and close

To classify many points at once, click **Lasso Select Multiple Points** (or hold `Shift` and drag) around them, then press a mineral key.

7.1.3 Mineral Keys

Each mineral is assigned a single letter or digit. The default keys are:

Q Quartz	P Plagioclase	K K-Feldspar	O Olivine	X Clinopyroxene
A Amphibole	H Hornblende	B Biotite	M Muscovite	G Garnet
C Calcite	D Dolomite	E Epidote	S Serpentine	Z Zircon

To change them, click **Configure Shortcuts** (the gear) in the toolbar. The **Configure Quick Classify Shortcuts** dialog lists each key and mineral; use **Add** for a new key, the delete icon to remove one, and **Reset to Defaults** to return to the list above. The same keys are used in Quick Edit (Section 7.3).

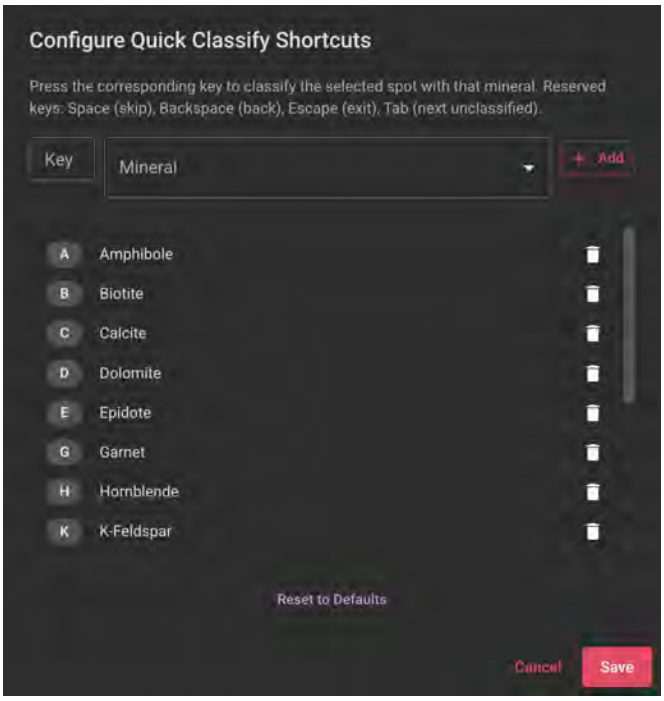


Figure 65. The Configure Quick Classify Shortcuts dialog.

7.1.4 Statistics

The statistics panel (**Statistics** button) opens automatically while you count. It shows:

- **Classification Progress:** *N* of *M* points classified.
- **Modal Composition:** a bar chart of the minerals.
- **Detailed Statistics:** a table with Mineral, Count, %, 95% CI and Range. The 95% confidence interval uses the Chayes method.
- **Export to CSV:** saves the summary table (session information, then one row per mineral with count, percentage and confidence interval).

7.1.5 Saving Sessions

A session is saved when you close the toolbar, when you move to another micrograph (StraboMicro asks first), and when you click **Save Session**. Sessions are stored in the project's `point-counts` folder, so they travel with the project in .smz exports and sync. The results of the micrograph's sessions also appear in the **Point Count Results** section of the Properties panel.

7.2 Grain Detection

Grain Detection outlines the grains of a micrograph automatically and turns them into polygon spots. (To outline chosen grains one click at a time, use Grain Spot, Section 5.15.) Open it with `Tools > Grain Detection...` (`Cmd+Shift+G` on macOS, `Ctrl+Shift+G` on Windows/Linux).

The **Grain Detection** dialog offers two methods, chosen with the **Method** switch at the top:

- **FastSAM (AI):** a neural network for image segmentation. Marked **Recommended**; it is the default once its model is installed.
- **OpenCV:** classical computer vision (edge detection and watershed segmentation).

Detection runs automatically half a second after you change a setting, so you see the effect of each change in the preview. The preview shows the detected outlines in orange; use **Zoom In**, **Zoom Out** and **Fit to View** (or the mouse wheel and dragging) to inspect them. The number of grains found and the time taken are shown below the preview.

7.2.1 FastSAM (AI) Method

The first time, click **Download Model (276MB)**. The model is downloaded once from HuggingFace and kept in the application's settings folder. Detection runs on your computer's processor on every platform (no graphics card is needed, and no image leaves your computer).

Settings:

- **Confidence Threshold** (10 to 90%, default 50%): higher values keep only grains the model is more certain of.
- **Minimum Grain Size** (as a percentage of the image, default 0.03%): ignores smaller regions.
- **Overlap Threshold (IOU)** (30 to 90%, default 70%): how much two detections may overlap before one is dropped.
- **Morphological cleanup (cleaner boundaries)**: smooths the outlines (on by default).

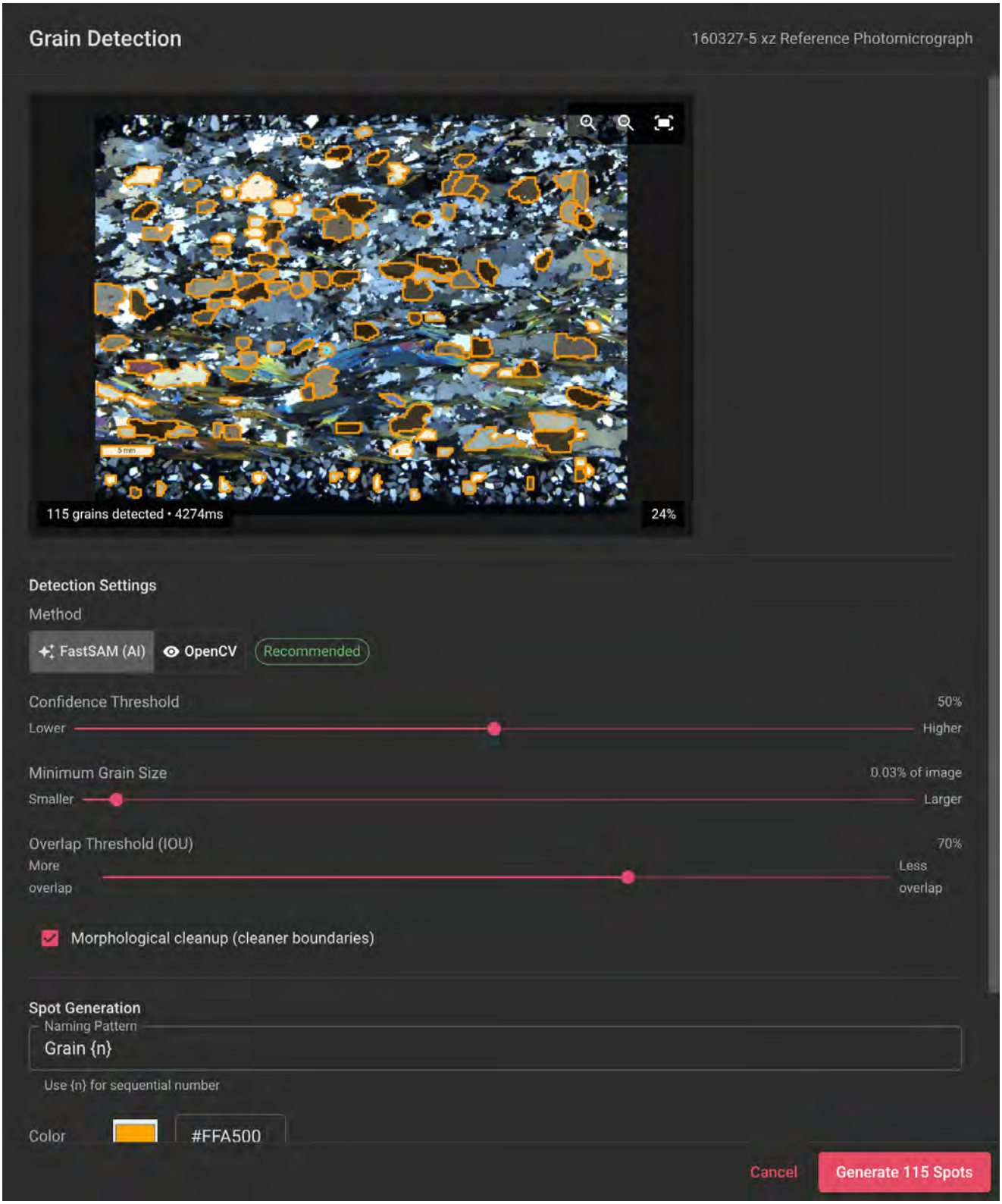


Figure 66. Grain detection with FastSAM: detected grains outlined on the micrograph.

7.2.2 OpenCV Method

Settings:

- **Preset:** starting values for common rocks: **Granite XPL**, **Granite PPL**, **Basalt**, **Marble**, **Sandstone**. Changing any setting switches the preset to **Custom**.
- **Sensitivity** (0 to 100%, default 50%): higher finds more boundaries (and more noise).

- **Minimum Grain Size** (10 to 500 square pixels, default 50): ignores smaller regions.
- **Edge Contrast** (0 to 100%, default 50%): from soft to sharp edges.
- **Simplify outlines (fewer vertices)**: on by default.

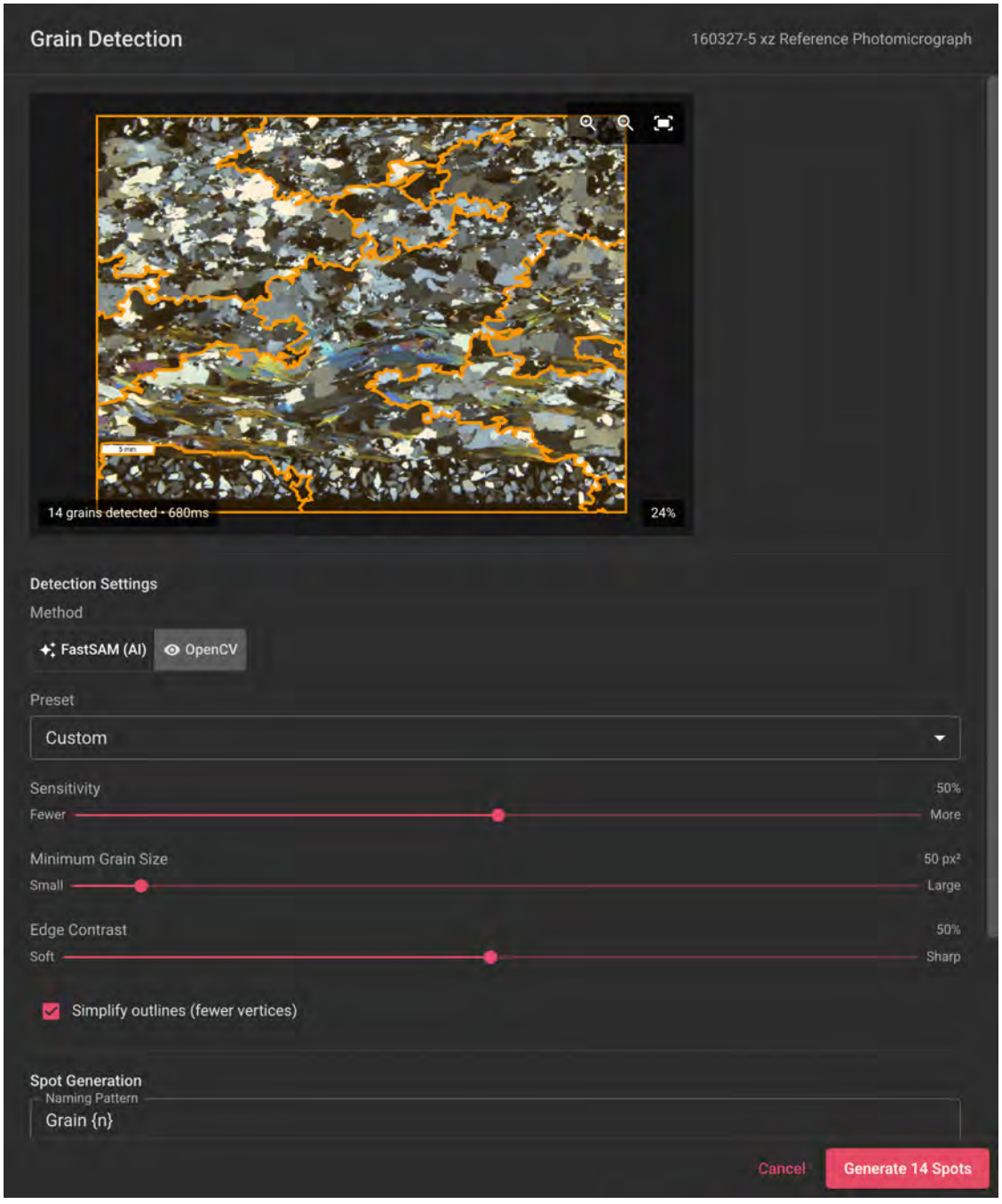


Figure 67. The Grain Detection dialog with the OpenCV method selected.

7.2.3 Creating the Spots

The **Spot Generation** section sets how the spots are made:

- **Naming Pattern:** default “Grain {n}”, where {n} is replaced by a number (Grain 1, Grain 2, ...).
- **Color** (default orange) and **Opacity** (default 50%).

- **Open Quick Edit for classification:** when checked (the default), Quick Edit starts right after the spots are made, so you can assign minerals grain by grain (Section 7.3).

Click **Generate *N* Spots** to add all detected grains to the micrograph as polygon spots. Remove unwanted grains afterwards in Quick Edit, or select and delete them.

7.3 Quick Edit

Quick Edit steps through the spots of a micrograph one at a time so you can classify, review or delete them from the keyboard. It is made for the hundreds of spots that Grain Detection creates, but works on any spots. Open it with `Spot > Quick Edit Spots...` (`Cmd+Shift+Q` / `Ctrl+Shift+Q`).

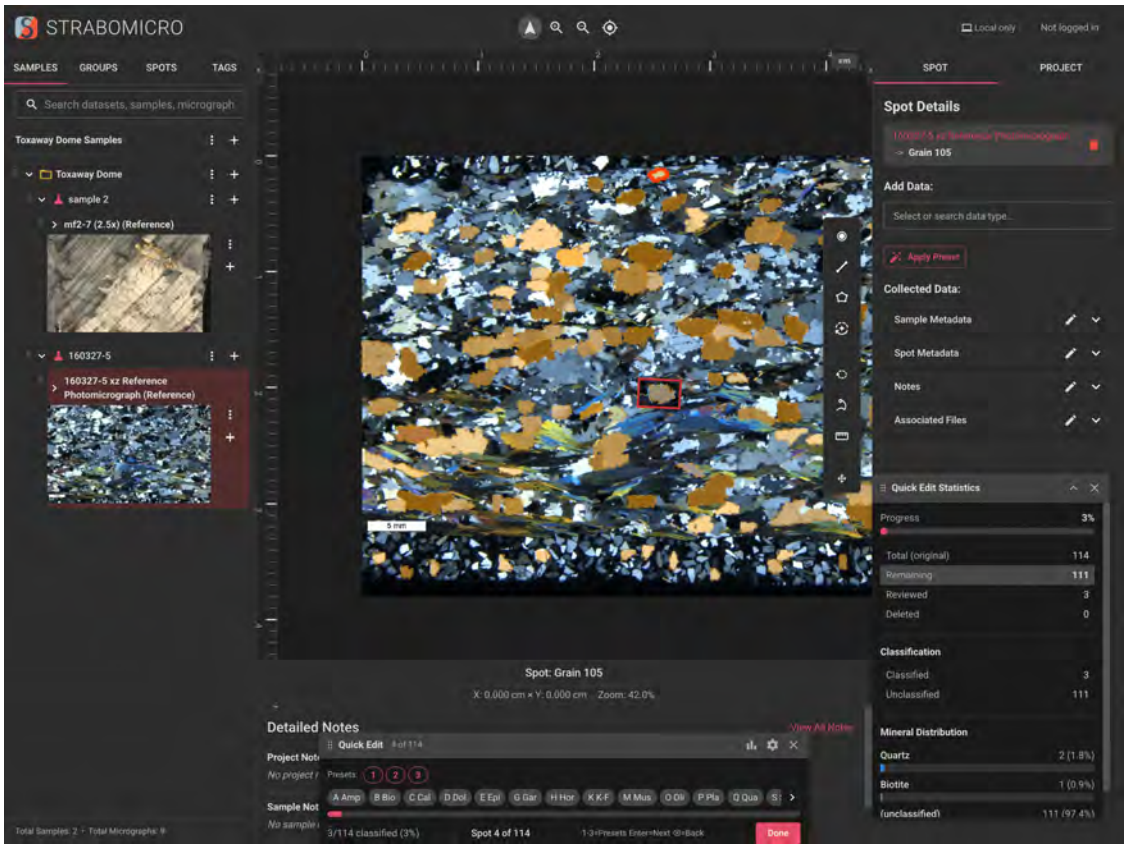


Figure 68. Quick Edit: the current spot, the Quick Edit toolbar and the statistics panel.

7.3.1 Starting Quick Edit

The **Quick Edit Spots** dialog asks:

- **Include spots: All spots on this micrograph** or **Unclassified spots only**.
- **Sort order: Spatial (left-to-right, top-to-bottom)**, **By size (largest first)**, **By creation time** or **Random order**.

It shows how many spots will be included. Click **Start**.

7.3.2 Keys

Key	Action
Mineral key (for example `Q`)	Assign the mineral, mark the spot reviewed and go to the next spot
`1` to `9`	Apply the Quick Spot Preset bound to that key (Section 7.4)
`Space` or `Enter`	Mark the spot reviewed and go to the next spot
`Tab`	Next unclassified spot
`Backspace`	Previous spot
Arrow keys, `[` and `]`	Previous or next spot in the chosen order
`Delete`	Delete the current spot (or all lasso-selected spots)
`Esc`	Clear the selection; otherwise end Quick Edit

The mineral keys are the same as in Point Count (Section 7.1.3). While the Quick Edit toolbar is open, the drawing tool keys (`V`, `P`, `L`, `G`, `M`) are turned off so that they can be used as mineral keys. Every change can be undone with `Cmd+Z` / `Ctrl+Z`.

To work on many spots at once, hold `Shift` and drag a lasso around them (or use the **Lasso Select** button in the drawing toolbar), then press a mineral key to classify them all or `Delete` to delete them all.

7.3.3 Statistics

The **Quick Edit Statistics** panel shows the original total, how many spots remain, are reviewed, deleted, classified and unclassified, and the distribution of minerals so far. Click **Done** in the toolbar when you are finished.

7.4 Quick Spot Presets

A Quick Spot Preset is a saved combination of spot appearance and geological data (for example “Quartz, strained” with its color, mineralogy and extinction data) that you can apply to spots in one step. Open the presets with `Spot > Quick Spot Presets...` (`Cmd+Shift+P` / `Ctrl+Shift+P`).

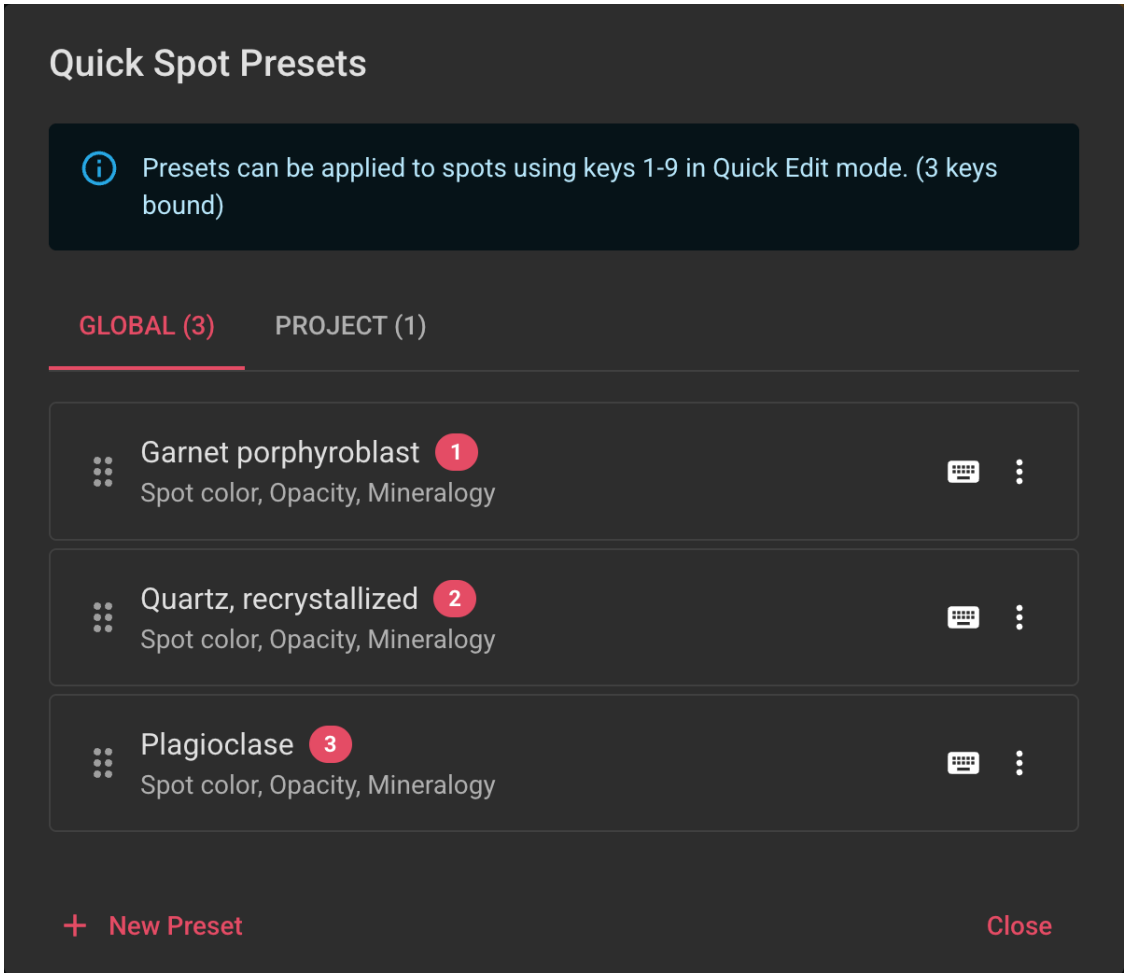


Figure 69. The Quick Spot Presets dialog with Global and Project presets and their key bindings.

7.4.1 Global and Project Presets

The dialog has two tabs:

- **Global:** presets available in every project on this computer.
- **Project:** presets saved in the current project. They travel with the project and, in a synced project, are shared with your collaborators.

Only Project presets are shared with collaborators. Global presets stay on your computer until you copy them into a project.

Drag presets to reorder them. Each preset's **…** menu offers **Edit**, **Duplicate**, **Copy to Project** or **Copy to Global**, and **Delete**.

7.4.2 Reusing Presets in a New Project

Keep the presets you use often on the **Global** tab. In a new project, open the **Project** tab and click **Copy from Global**, or use **Copy All to Project** on the Global tab. To save a good set from a project for later, use **Copy All to Global** on its Project tab.

If the target already has a preset with the same name, you choose **Keep Existing** or **Replace Them**. Tags belong to one project, so they are not copied to Global or written to a file.

Export… saves the presets on the current tab to a JSON file, and **Import…** adds presets from such a file to the current tab. Use these for a backup, to move to another computer, or to give your presets to a colleague.

Number keys are remembered per project on each computer and are not shared with collaborators. A key on a Global preset works in every project, unless that project uses the key for one of its own presets. When you copy a Global preset into a project, its key moves to the copy in that project.

7.4.3 Creating a Preset

Click **New Preset**. The editor has:

- **Preset Name** and **Description (optional)**.
- **Spot Name (auto spot mode, optional):** a name pattern such as "Ol-{n}" for spots made in auto spot mode with this preset (Section 5.14).
- **Copy from Selected Spot:** fills the preset from the selected spot (shown only when a spot is selected).
- **Scope:** Global or Project.
- **Spot Appearance: Spot Color** and **Opacity**.
- **Geological Data:** use **Add Data Type** to add Mineralogy/Lithology, Grain Size/Shape/SPO, Fabrics, Fractures, Veins, Folds, Clastic Deformation Bands, Grain Boundaries, Intragranular Structures, Pseudotachylyte, Faults/Shear Zones or Extinction Microstructures.
- **Tags** (Project presets only, because tags belong to a project): tags to add to each spot the preset is applied to.

Click **Create** (or **Save** when editing).

7.4.4 Key Bindings

Click the keyboard icon (**Bind key (1-9)**) next to a preset to give it a number key. Bound presets can be applied with that key in Quick Edit, and chosen with that key in auto spot mode. The dialog shows how many keys are bound.

7.4.5 Applying Presets

- In the **New Spot** and **Edit Spot** dialogs, choose presets in **Apply Presets**.
- With a spot selected, click **Apply Preset** in the Properties panel.
- In Quick Edit, press the preset's number key (the bound presets are shown as chips in the toolbar).
- In auto spot mode, choose the preset in the bar at the top of the viewer; every new spot gets it (Section 5.14).

How a preset combines with existing data: applying a preset never erases data. The preset's color and opacity replace the spot's; minerals, other geological data and tags are added to what

the spot already has; notes are added on a new line. A preset that was already applied to a spot is not applied to it a second time.

7.5 Grain Size Analysis

Grain Size Analysis measures the size and shape of polygon spots and summarizes the grain population. Open it with `Tools > Grain Size Analysis...` (`Cmd+Shift+A` / `Ctrl+Shift+A`), or click **Open Full Analysis...** in the **Grain Size Analysis** section of the Properties panel. Only polygon spots are analysed.



Figure 70. Grain Size Analysis: size histogram, orientation rose diagram and statistics.

7.5.1 Choosing the Grains

- **Rock Type: Sedimentary**, **Igneous** or **Metamorphic**. Sets the size classes shown on the histogram.
- **Scope: Current micrograph** or **All micrographs** (every micrograph in the project).
- **Spots: All spots**, or **Selected spots** with a checklist (**Select All** / **Select None**). Your choice of spots is saved with the project.

7.5.2 Per-Grain Measurements

For each polygon:

- **Area** and **Perimeter**.
- **Equivalent Diameter:** the diameter of a circle with the same area, $\mathrm{d_{eq}} = 2\sqrt{\mathrm{A}/\pi}$.
- **Aspect Ratio:** major axis divided by minor axis of the best-fit ellipse.

- **Orientation:** angle of the long axis of the best-fit ellipse, counterclockwise from the image horizontal (0 to 180°; 0° towards the right side of the image).
- **Circularity:** $4\pi A/P^2$ (1.0 is a perfect circle).

7.5.3 Statistics

- **Summary:** number of grains, total area, and coverage (the share of the image covered by the grains).
- **Size (equivalent diameter):** mean, median, standard deviation, range and skewness. For the Sedimentary rock type, the Folk and Ward sorting coefficient and its sorting class are also shown.
- **Shape:** mean aspect ratio, mean circularity and the preferred orientation (mean $\pm$ angular standard deviation).
- **By Mineral:** grain count and size per mineral, when the grains have more than one mineral.

7.5.4 Size Classes

The histogram shows the size classes of the chosen rock type as colored bands:

Sedimentary (Wentworth) Clay $<$ 4 μm; Silt 4 to 62 μm; Very Fine Sand 62 to 125 μm; Fine Sand 125 to 250 μm; Medium Sand 250 to 500 μm; Coarse Sand 500 μm to 1 mm; Very Coarse Sand 1 to 2 mm; Granule 2 to 4 mm; Pebble $>$ 4 mm.

Igneous Aphanitic $<$ 1 mm; Fine Phaneritic 1 to 5 mm; Medium Phaneritic 5 to 30 mm; Coarse Phaneritic $>$ 30 mm.

Metamorphic Very Fine $<$ 0.1 mm; Fine 0.1 to 1 mm; Medium 1 to 5 mm; Coarse $>$ 5 mm.

7.5.5 Charts

- **Size Distribution:** a histogram of equivalent diameters (15 bins), with **Log scale** and **Grid** options and the size-class bands.
- **Orientation:** a rose diagram of the long-axis orientations of the best-fit ellipses of the polygon spots (the ellipse with the same area and second moments as each polygon, as in ImageJ). It is shown when the grains are elongated enough to have a meaningful orientation. Angles are measured counterclockwise from the image horizontal, with 0° towards the right side of the image. With **Current micrograph**, that is the micrograph image. With **All micrographs**, it is each polygon's reference micrograph: the polygon is measured as it lies on the reference, including any rotation of the associated micrograph it was drawn on, so all polygons from one thin section share the same 0°. When polygons from more than one reference micrograph are combined, a note says so, because those frames are not related. Long axes have no direction, so the diagram spans 0–180° and each sector is mirrored across the center. It is an equal-area rose: a petal's area is proportional to the number of polygons with long-axis directions that fall into that 10° bin, and the rings

are labeled with polygon spot counts. The red line (the mean orientation) and the dashed arc (the circular standard deviation, about 1 sd) are drawn only when the polygons share a preferred orientation, the same rule as the Preferred Orientation line under Statistics. The same angles are used for the preferred orientation and the OrientationDegrees column of the CSV export; the OrientationFrame column names each polygon's frame.

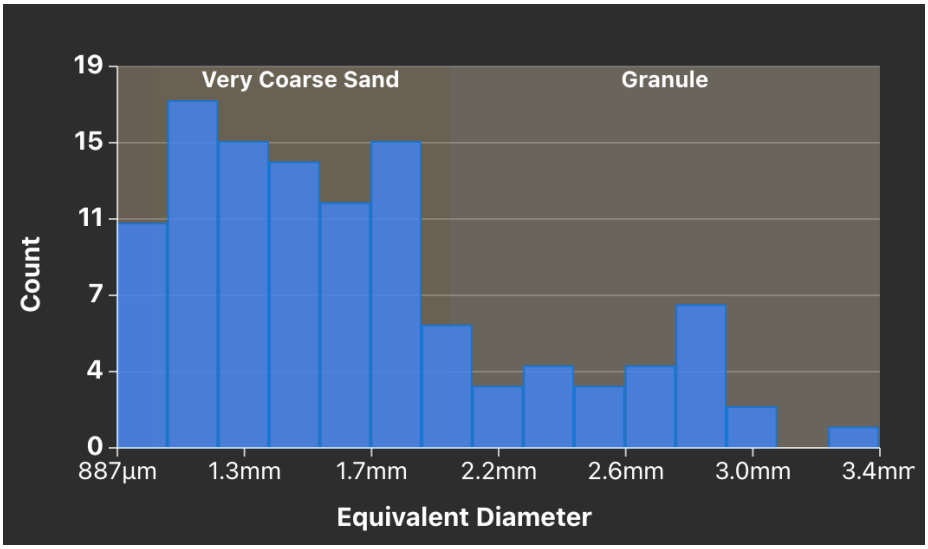


Figure 71. Grain size histogram with the Igneous size classes.

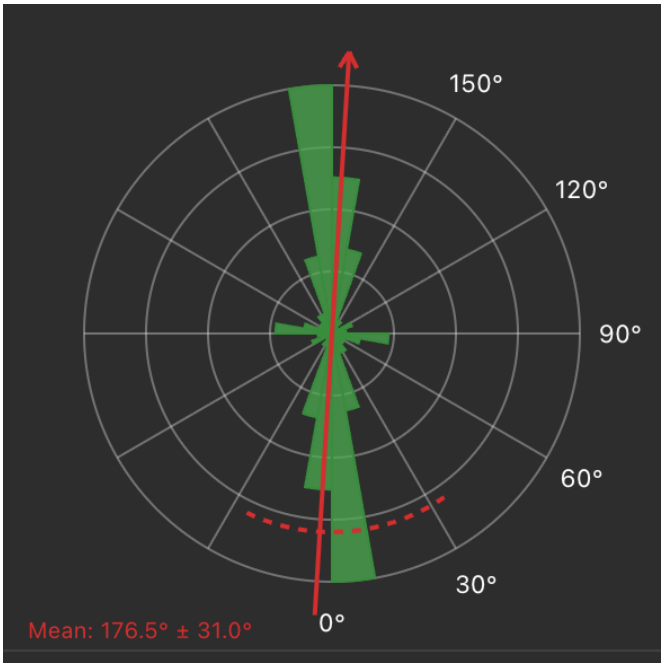


Figure 72. Rose diagram of grain long-axis orientations.

7.5.6 Export

- **Export CSV:** one row per grain with its spot name, mineral, area, perimeter, equivalent diameter, major and minor axes, aspect ratio, orientation and circularity.
- **Copy Statistics:** copies the statistics as text to the clipboard, for pasting into a spreadsheet or document.

7.6 Image Comparator

The Image Comparator shows two or four micrographs side by side in a full-screen window, for example PPL, XPL and BSE images of the same area, or similar features in different samples. Open it with `Tools > Image Comparator...`.

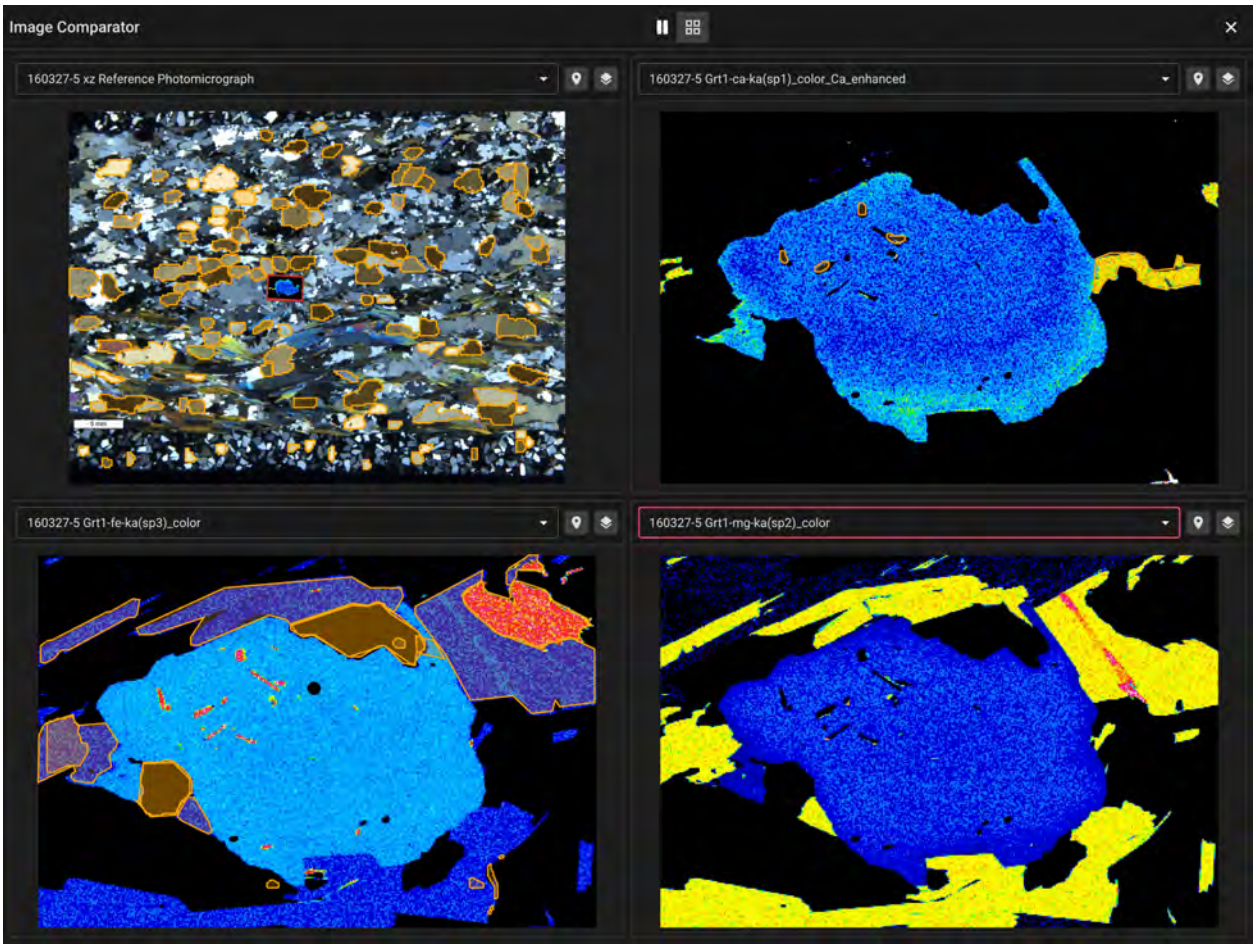


Figure 73. The Image Comparator with four micrographs.

- **Layout: 2 Images (Side by Side)** or **4 Images (Grid)**.
- **Micrographs:** choose a micrograph for each panel from its list (with thumbnails and sample names).
- **Show Spots / Hide Spots** and **Show Overlays / Hide Overlays** (associated micrographs), separately for each panel.
- **Navigation:** each panel zooms (mouse wheel) and pans (drag) on its own. Double-click a panel to fit its image.

Press `Esc` or click **Close** to leave the comparator.

7.7 Image Stitcher

The Image Stitcher joins several overlapping images of one area into a single image, a mosaic, which you then add to the project as one micrograph or save as an image file. Use it when a thin section or an area of interest was photographed in pieces, for example a set of fields of view

taken by moving the stage by hand. The images need no particular order, grid or file names. They only have to overlap their neighbors and be taken under the same lighting.

There are two ways to open it:

- `Tools > Image Stitcher...`, with or without a project open.
- **Stitch Images...** on the first step of the **New Reference Micrograph** and **New Associated Micrograph** dialogs (Section 5.3). The finished mosaic becomes the image of that micrograph.

Stitch one set at a time: plane- and cross-polarized images of the same area do not match each other, so make a separate mosaic of each.

7.7.1 Choosing the Images

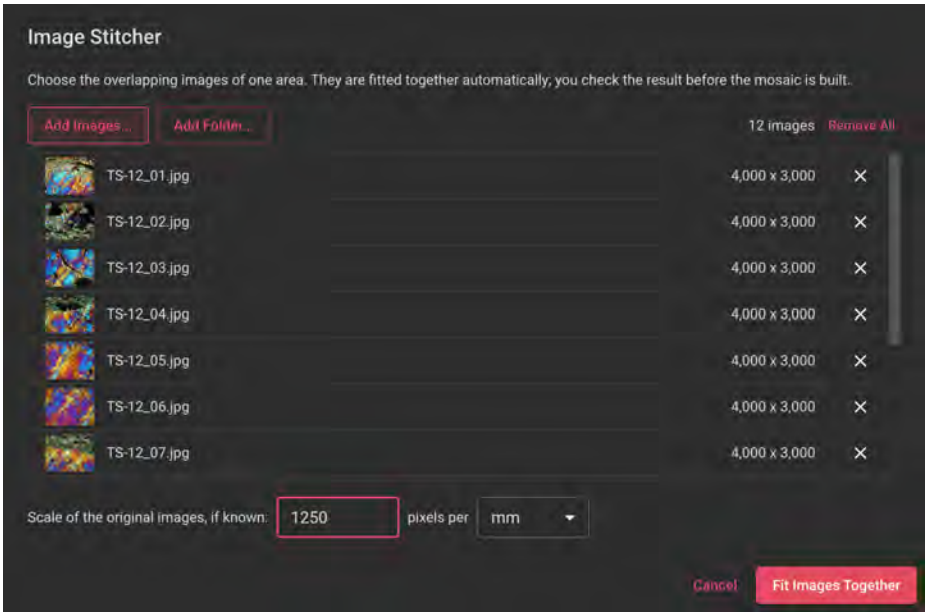


Figure 74. The first step of the Image Stitcher, with the images of one area chosen.

- **Add Images...** adds the image files you choose. **Add Folder...** adds every image in a folder (not in its subfolders). Supported formats: TIFF, JPEG, PNG and BMP.
- The list shows each image with its size in pixels. Remove one with the **x** at the end of its row, or all with **Remove All**. You can add more images at any time.
- A file that cannot be used stays in the list with the reason and is skipped ("1 image cannot be used and will be skipped.").
- **Scale of the original images, if known:** enter the pixels per unit of the images as they came from the microscope. StraboMicro works out the scale of the mosaic from it, so you do not have to set the scale again when the mosaic is added to the project. Leave it empty if you do not know it.

At least two usable images are needed, and at most 200 can be stitched in one go. For a larger set, stitch it in parts. From 60 images on, the dialog says about how long the next step will take.

Click **Fit Images Together**.

7.7.2 Fitting the Images Together

StraboMicro compares every image with every other, finds where they overlap by matching features in both, and works out the layout. The dialog shows the stages (**Reading images**, **Comparing images**, **Working out the layout**) and how many overlaps were found so far. If some images could not be placed, it looks harder at just those (“Looking harder at 3 images”); **Skip** ends that stage and goes to the review. **Cancel** returns to the list of images.

7.7.3 Reviewing the Mosaic

Nothing is built before you have seen it. The **Review the mosaic** step shows a preview of the mosaic on the left and the list of images on the right, and its first line says how the fitting went, for example “All 12 images placed automatically” or “10 of 12 images placed automatically”.

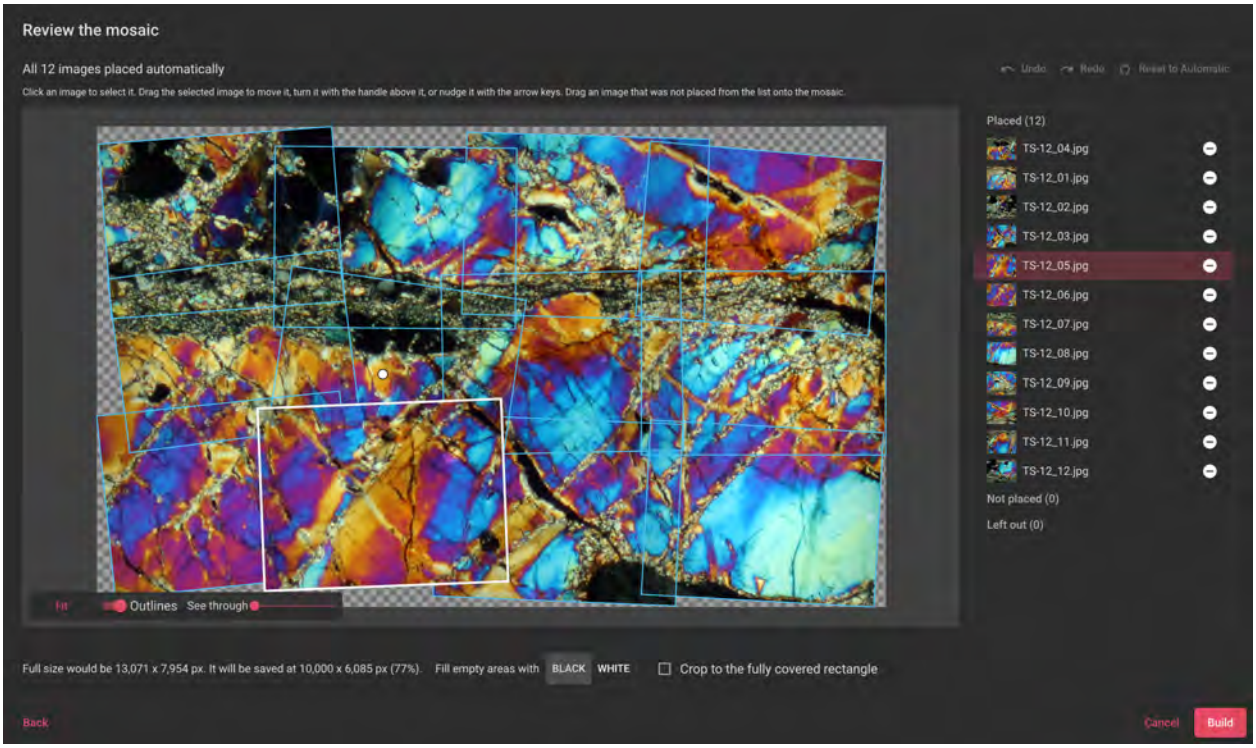


Figure 75. Review the mosaic: the preview with the outline of each image, and the list of images.

The preview. Zoom with the mouse wheel and drag to pan; **Fit** shows the whole mosaic again. Images in view become sharper when you zoom in. **Outlines** shows or hides the outline of each image. Areas that no image covers are shown with a checkered pattern.

The list has three parts:

- **Placed:** the images in the mosaic. Click a row to select that image in the preview, or click the image in the preview.
- **Not placed:** images that were found to fit no image of the mosaic. Images that fit each other but not the mosaic are listed together as a group (“Group of 4 that fit each other”).
- **Left out:** images you took out of the mosaic yourself.

Seams to check. The outline of an image shows how it was placed: light blue for an image that fits well, amber for a weak overlap, purple for an image placed by hand. An image with a weak

overlap is also marked **Weak overlap: check this seam** in the list. It matched its neighbors at only a few points, or is held by a single neighbor through a weak match. Zoom in on its edges and check that grains continue across them.

7.7.4 Changing the Layout by Hand

- **Move an image:** click it to select it, then drag it. When you let go, StraboMicro looks for an exact fit near that place. The line under the preview then says **Snapped to fit.**, or that no exact fit was found; in that case the image stays where you put it and is marked **Placed by hand**.
- **Turn an image:** drag the round handle above the selected image.
- **Nudge an image:** press the arrow keys to move the selected image in small steps (hold `Shift` for larger steps).
- **See through:** the slider under the preview makes the selected image partly transparent, so you can compare it with the images beneath it.
- **Place an image that was not placed:** drag its row from the list onto the mosaic, about where it belongs, or click the **+** button of its group to put it in the middle of the view. It snaps to an exact fit when one is found. A group moves as one piece; **Separate** breaks it into single images.
- **Leave an image out:** click the button at the end of its row (**Leave out of the mosaic**). It moves to **Left out**, where the same button puts it back.
- **Go back:** **Undo** and **Redo** step through your changes. The reset button in the row of a changed image returns that image to its automatic place, and **Reset to Automatic** returns everything.

7.7.5 Size, Empty Areas and Cropping

Under the preview, the dialog states the size of the mosaic. Like every micrograph, a mosaic is at most 10,000 pixels on its longer side. A larger one is saved reduced, and the dialog says so before you build it ("Full size would be 18,400 x 14,200 px. It will be saved at 10,000 x 7,717 px (54%)."). The full detail of the original images is not lost if you add them with the mosaic (see *Keeping the Original Images* below).

If the images do not fill a rectangle, choose how the empty areas are treated:

- **Fill empty areas with Black** or **White**.
- **Crop to the fully covered rectangle:** the mosaic is cut down to the largest rectangle with no empty area, shown as a dashed white rectangle in the preview.

7.7.6 Scale Bars and Other Magnifications

- **Scale bars and labels in the images.** If the microscope software drew a scale bar or label into the images, the review step says so, outlines each one with a dashed yellow rectangle, and marks the images **Scale bar or label** in the list. Where another image covers the same

spot, the mosaic uses that image's clean pixels, so most bars disappear. A bar that no other image covers stays in the mosaic.

- **An image at another magnification.** An image taken at a clearly different magnification than the others is named in a warning with a **Leave Out** button. In the mosaic, a more magnified image loses its extra detail, and a less magnified one looks blurred next to the others. A more magnified image that you leave out can still be added in its place: it is included when you add the original images on the last step, or you can add it yourself afterwards as an associated micrograph with the location method **Place automatically on parent** (Section 5.4.4).

7.7.7 Building and Using the Mosaic

Click **Build**. When the progress bar finishes, the last step, **The mosaic is ready**, shows the number of images, the size of the mosaic and, if you entered a scale, the scale of the mosaic. **Back** returns to the review if you want to change something and build again.



Figure 76. The mosaic is ready: where it goes, and whether the original images are added with it.

Opened from the **Tools** menu with a project open, the step asks where the mosaic goes:

- **Add to the project as a new reference micrograph:** choose the **Sample** and click **Continue**. The **New Reference Micrograph** dialog opens with the mosaic as its image (Section 5.3).
- **Add to the project as an associated micrograph:** choose the **Parent micrograph** and click **Continue**. The **New Associated Micrograph** dialog opens with the mosaic as its image (Section 5.4).
- **Save as an image file:** click **Save as an Image File...** and choose a name and a format (JPEG, PNG or TIFF). The mosaic is not added to the project.

With no project open, or in a shared project where you may not add micrographs, the mosaic can only be saved as an image file. Opened with **Stitch Images...**, the step has **Use This Mosaic**, which returns to the New Micrograph dialog you came from, and **Save as an Image File...**.

In the New Micrograph dialog the mosaic behaves like any other image: you can turn or flip it in the Image Rotation step, and you fill in the instrument and other information as usual. Its name is suggested from what the file names of its images have in common (for example "TS-12

mosaic"), and if you entered a scale in the stitcher, the scale is already filled in. The mosaic is added to the project when you click **Finish**. If you cancel before that, StraboMicro asks **Discard this mosaic?** and offers **Save as an Image File...** so the work is not lost.

7.7.8 Keeping the Original Images

When the mosaic goes into the project, the last step of the stitcher also offers **Also add the *N* original images as associated micrographs of the mosaic**. It is unchecked at first. Check it to keep the originals in the project:

- Each original image becomes an associated micrograph of the mosaic, placed where it lies on the mosaic and named after its file. Its scale is worked out from the mosaic's, and it gets the mosaic's instrument and image type.
- The originals keep their full detail. This matters most when the mosaic had to be reduced to 10,000 pixels.
- They start hidden, so you see the mosaic itself. Show one with the eye icon beside it in the project tree, or all of them with **Show All Associated Micrographs** in the mosaic's menu (Section 5.10). A shown original lies on top of the mosaic at its place and is sharper when you zoom in.
- The originals are the images in the mosaic, plus any image you left out because of its magnification. Images under **Not placed** and images left out for other reasons are not added.
- The mosaic and its originals are added together when you click **Finish**, and one `Edit > Undo` removes them together.

Note: Hiding a micrograph with the eye icon applies to you on this computer only. In a shared project, your collaborators see the originals over the mosaic until they hide them, and so do the web viewer and PDF reports.

7.8 StraboTools

7.8.1 Background

StraboTools began as an iOS app for quantitative analysis of photographs of outcrops and hand samples. It was first built for plutonic rocks such as granite, where fabric and mineral proportions matter, but its analyses apply to many rock types and to thin sections. StraboMicro includes the four StraboTools analyses for micrographs.

7.8.2 Opening StraboTools

Open it with `Tools > StraboTools...` (`Cmd+Shift+T` / `Ctrl+Shift+T`), or choose **Open in StraboTools** in a micrograph's menu in the project tree. Choose the micrograph at the top of the window and the analysis with the tabs. The preview is computed on a reduced copy of the image; saving processes the full-resolution image.

7.8.3 Edge Fabric

The Edge Fabric tool measures rock fabric from the image's brightness gradients and draws an ellipse that summarizes the dominant orientations. The **Azimuth** is the direction of the ellipse's long axis (the principal fabric direction) and the **Axial Ratio** is an estimate that correlates with the intensity of the fabric. The tool has no settings.

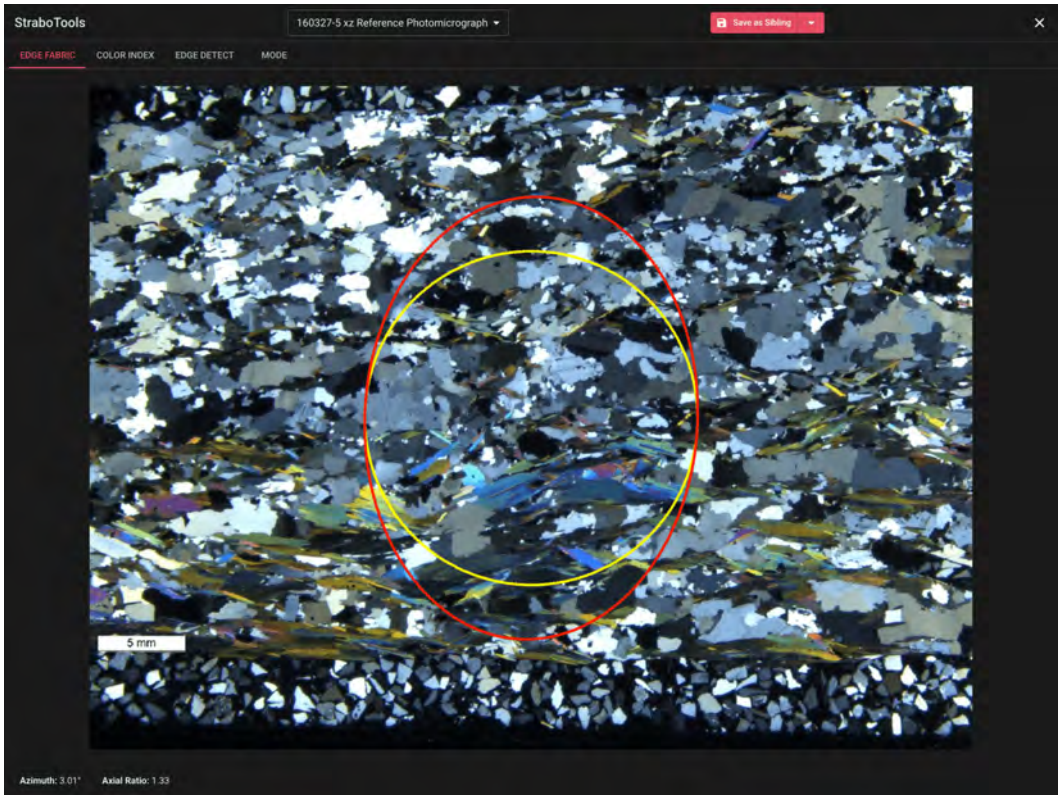


Figure 77. Edge Fabric: the fabric ellipse over the image's brightness gradients.

7.8.4 Color Index

The Color Index tool estimates the proportion of dark minerals as the percentage of pixels darker than a threshold.

- **Threshold:** 0 to 255 (default 128).
- **Global** or **Adaptive** thresholding: global compares every pixel with the same threshold; adaptive compares each pixel with its surroundings, which helps with uneven lighting.
- Highlight color: **Red** or **Blue**.

The result is shown as **Color Index: *x*%**.

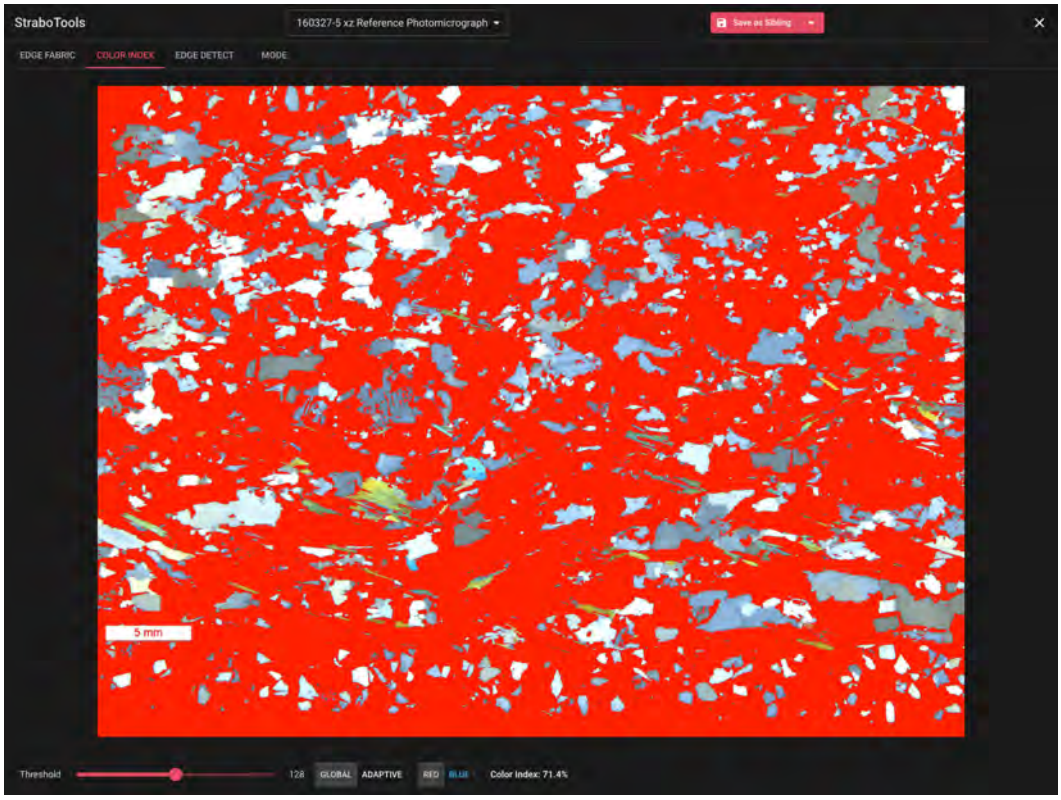


Figure 78. Color Index: dark pixels highlighted by the threshold.

7.8.5 Edge Detect

The Edge Detect tool applies an edge filter that brings out boundaries and subtle structures, for example before an Edge Fabric analysis. Its **Threshold** (0 to 255, default 128) sets how strong an edge must be to be shown.

7.8.6 Mode

The Mode tool divides the image into a chosen **Number of Phases** (2 to 6, default 4) by color, shows each phase in its own color (black, white, pink, green, lavender, blue), and lists the percentage of the image each phase covers. It gives a quick, repeatable estimate of modal proportions.

7.8.7 Saving the Result

The **Save as Sibling** button saves the processed image as a new micrograph next to the original, named "*original name - tool*", with the same location and scale. Its menu also offers **Save as Replacement to Original Micrograph**, which replaces the original image file after a warning (**Replace Original Image?**). Replacing cannot be undone.

The results (azimuth and axial ratio, color index, phases and their percentages) are stored with the micrograph and shown in the **StraboTools** section of its Properties panel.

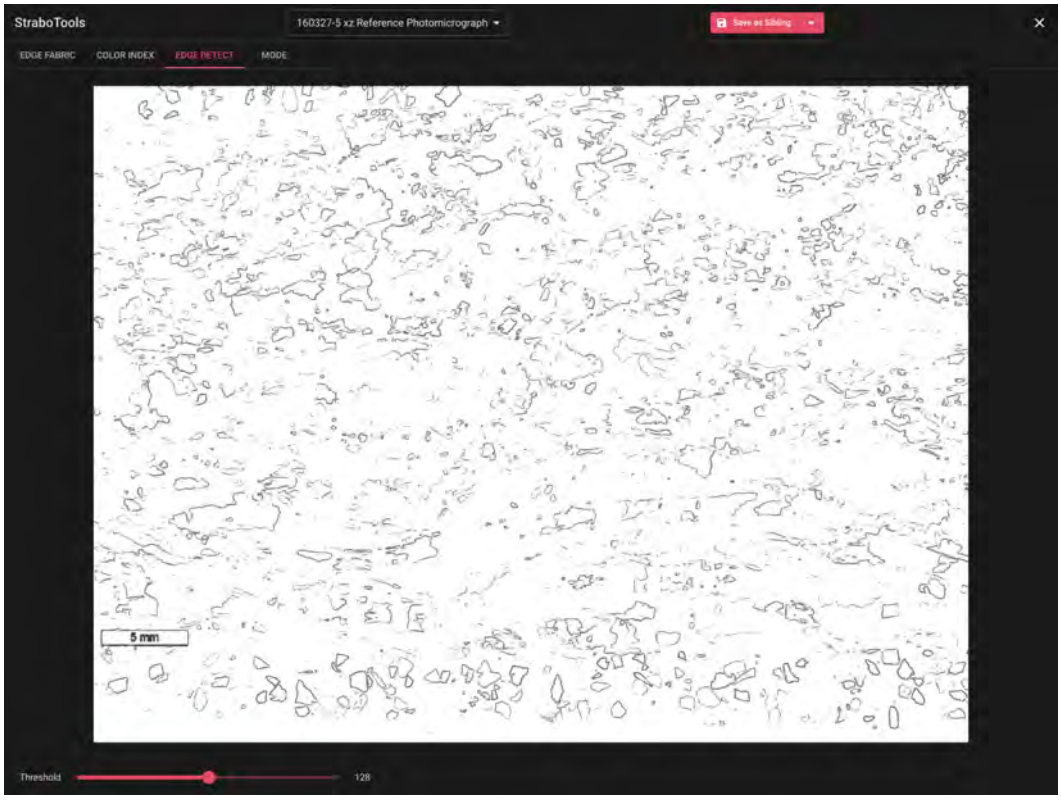


Figure 79. Edge Detect output.

7.9 Custom User Data

Custom User Data adds your own data to spots from a spreadsheet: analysis numbers, mineral chemistry, ages or anything else that has no place in the standard data types. You download a template with one row per spot, add your own columns, fill them in and import the file. Each row is matched to its spot by its Spot ID. Open it with `Tools > Custom User Data...`.

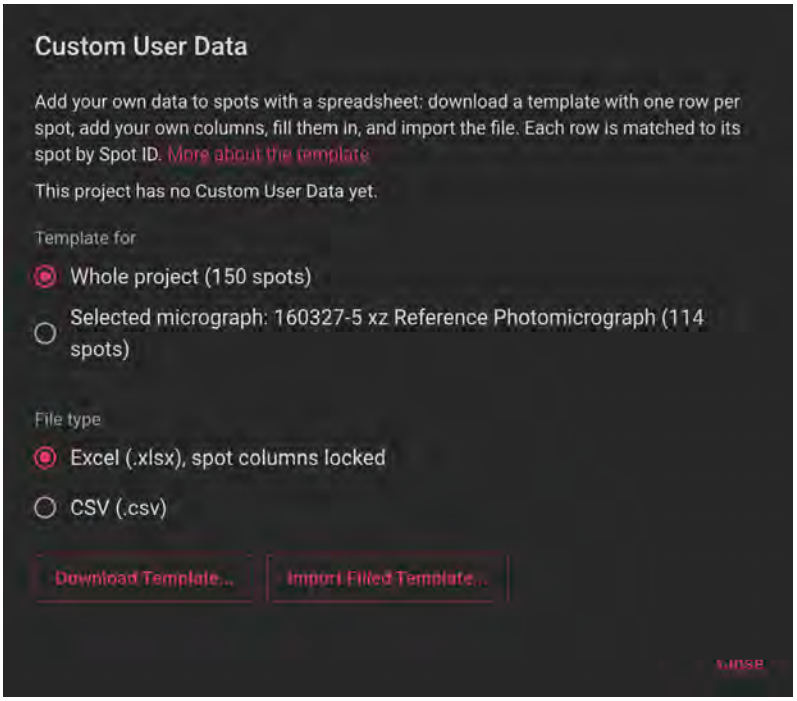


Figure 81. The Custom User Data dialog. **More about the template** shows how to fill in the template.

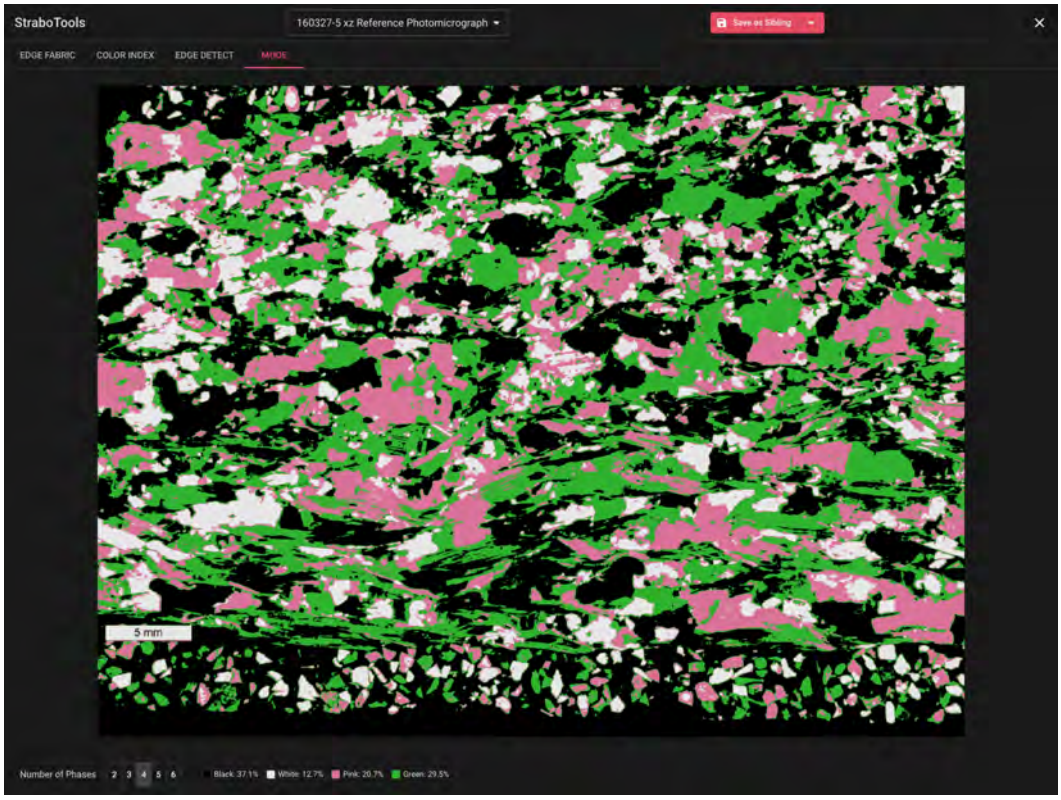


Figure 80. Mode: the image divided into phases, with their percentages.

7.9.1 Download the Template

Choose what the template covers and its file type, then click **Download Template...**:

- **Template for: Whole project** (every spot) or **Selected micrograph** (the spots of the micrograph in the viewer).
- **File type: Excel (.xlsx)** or **CSV (.csv)**.

The template has one row per spot and four grey columns that identify it: **Sample Name**, **Micrograph Name**, **Spot Name** and **Spot ID**. In an Excel file these columns are locked, and an **Instructions** sheet explains how to fill in the template. A CSV file cannot lock columns, so leave them as they are. If the project already has Custom User Data, the template includes the current values, so a downloaded file can be edited and imported again.

Sample Name	Micrograph Name	Spot Name	Spot ID	Mineral	Mg#
160327-5	160327-5 xz Reference	Grain 1	3f9c1000-8b1e-4c47-a6d2-90e1b5c7d210	Garnet	0.21
160327-5	160327-5 xz Reference	Grain 2	3f9c1001-8b1e-4c47-a6d2-90e1b5c7d211	Biotite	0.48
160327-5	160327-5 xz Reference	Grain 3	3f9c1002-8b1e-4c47-a6d2-90e1b5c7d212	Plagioclase	
160327-5	160327-5 xz Reference	Grain 5	3f9c1003-8b1e-4c47-a6d2-90e1b5c7d213	Garnet	0.19
160327-5	160327-5 xz Reference	Grain 6	3f9c1004-8b1e-4c47-a6d2-90e1b5c7d214	Quartz	
160327-5	160327-5 xz Reference	Grain 7	3f9c1005-8b1e-4c47-a6d2-90e1b5c7d215	Biotite	0.51

Figure 82. A filled template: the grey spot columns, then the user's own columns (**Mineral** and **Mg#**).

7.9.2 Fill In the Template

- Add your own column headers in row 1, to the right of the grey columns: one column per kind of data. Headers may contain spaces and symbols, for example `Mg#` or `Age (Ma)`.

- Fill in a value for each spot, or leave the cell empty. Values are kept as text, exactly as typed: `0.820`, `<0.01` and `n.d.` all stay as they are.
- Do not change the Spot ID, and do not add rows: rows never create spots. Draw the spots in StraboMicro first, then download a new template. To rename a spot or micrograph, rename it in StraboMicro.
- The row order does not matter. Excel does not sort locked cells; to sort, choose `Review > Unprotect Sheet` in Excel first (there is no password).

7.9.3 Import the File

Click **Import Filled Template...** and choose the saved `.xlsx` or `.csv` file. StraboMicro checks the file first and shows what will change before anything is applied:

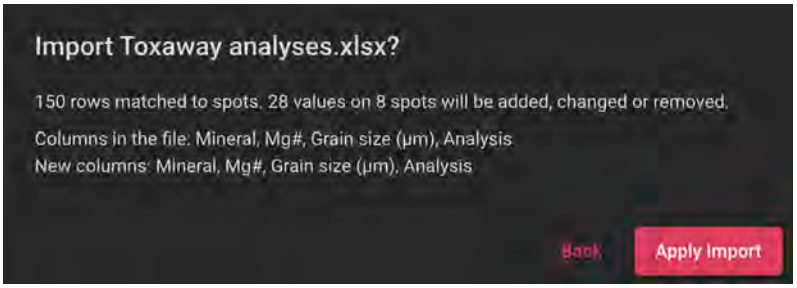


Figure 83. The import preview.

- How many rows were matched to spots and how many values will be added, changed or removed, and which columns are new.
- Rows whose Spot ID is not in this project (a deleted spot, an edited ID or a file from another project), and rows with values but no Spot ID. These rows are skipped.
- Names in the file that differ from the project. Rows are matched by Spot ID, so the project's names are kept.

Click **Apply Import** to apply the changes, or **Back** to leave everything as it was. The import is one step for `Edit > Undo`.

Importing again updates only the columns in the file; other columns stay as they are. An empty cell removes that value, and spots that are not in the file are not changed. A file is refused, with nothing changed, if a header is blank over values, two columns have the same header (capitals and spaces do not count), a header repeats one of the grey columns, the Spot ID column is missing, or two rows have the same Spot ID.

7.9.4 View, Download and Remove

A spot with Custom User Data shows a **Custom User Data** section under **Collected Data** in the Properties panel, with each header and value. Values cannot be edited there; edit the spreadsheet and import it again.

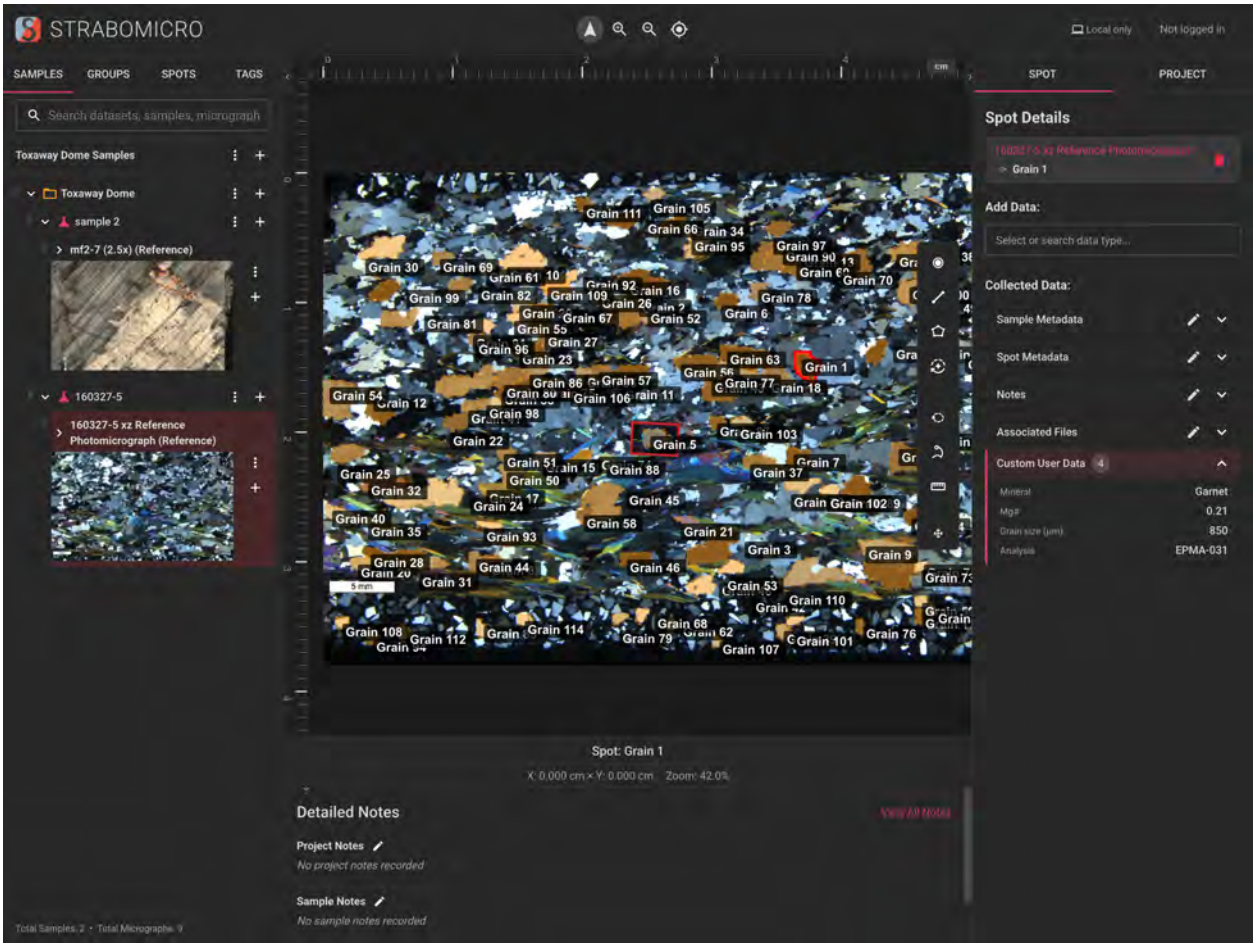


Figure 84. A spot's Custom User Data in the Properties panel.

For a micrograph, the **Custom User Data** section shows how many of its spots have data. **Show Custom User Data...** opens a table with one row per spot. Click a row to select that spot. **Download...** saves the micrograph's table as **Excel (.xlsx)** or **CSV (.csv)**. The **Project** tab of the Properties panel has the same section for the whole project: its table adds **Sample** and **Micrograph** columns, and clicking a row takes you to that spot (its micrograph opens and the view zooms to it).



Figure 85. The Custom User Data table of a micrograph.

The trash icon next to a column header removes that column, and **Remove All Custom User Data...** removes every column. Both apply to the whole project, ask for confirmation first and can be undone with `Edit > Undo`.

Custom User Data is included in the PDF report (in each spot's entry), in `.smz` files and on StraboSpot. The StraboSpot web viewer shows the same spot section and micrograph table, with a CSV download. In a shared project (Section 9), a Contributor's import changes only the spots they added, and new columns they add are listed after the others in alphabetical order; only the owner and Editors can remove columns. A Viewer can download but not import.

7.10 Configure Mineral Colors

With `View > View Spots by Mineral Color`, spots are drawn in the color of their mineral instead of their own spot color. `Spot > Configure Mineral Colors...` sets those colors:

- **Global Colors:** the colors used in every project on this computer. Add a mineral with the search field; **Reset to Defaults** restores the standard colors.
- **Project Overrides:** colors for this project only, which take priority over the global colors. **Clear All Overrides** removes them.

Switch back with `View > View Spots by Spot Color`.

7.11 Rebuild Tile Cache

StraboMicro displays large images from pre-made tiles kept in a cache on your computer. If an image shows seams, missing areas or other display problems, `Tools > Rebuild Tile Cache...` rebuilds the tiles of every micrograph in the open project. Your data and annotations are not changed. Click **Rebuild**; the dialog shows the progress and then how many micrographs were rebuilt (micrographs without a scale are skipped).

8 Sketch Overlay System

8.1 Introduction to Sketch Overlay

The Sketch Overlay system provides an “acetate overlay” capability for freeform annotations on your micrographs. Think of it as placing a transparent acetate sheet over a physical thin section slide and drawing on it with colored markers. You can add notes, highlight features, and mark up the image without affecting the underlying scientific data.

Key Concept: Sketches are intentionally separate from the scientific spot annotation system. While spots represent formal geological observations with structured metadata, sketches are designed for informal markup and visual communication.

8.1.1 Common Use Cases

- **Teaching and Presentations:** Highlight features of interest when explaining concepts to students or colleagues
- **Informal Markup:** Quickly mark areas for later investigation without creating formal spot annotations
- **Contextual Notes:** Add text labels and reminders directly on the micrograph
- **Feature Highlighting:** Use the marker tool to draw attention to specific regions
- **Collaborative Review:** Annotate micrographs for discussion with collaborators
- **Draft Annotations:** Sketch preliminary boundaries before creating formal polygon spots

Multiple sketch layers can be created per micrograph, allowing you to organize different types of annotations separately, for example one layer for grain boundaries and another for teaching notes. Sketches are saved with the project and, in a synced project, shared with your collaborators.

8.2 Entering and Exiting Sketch Mode

Sketch mode provides a dedicated drawing environment with specialized tools for freeform annotation.

8.2.1 Entering Sketch Mode

Select a micrograph (not a spot), then use one of the following methods:

- Click the **Sketch Mode** button in the drawing toolbar (Figure 87).
- In the **Sketches** tab of the Metadata Pane, click a layer, or **New Layer**.

When sketch mode is active:

- The drawing toolbar is replaced by the sketch toolbar, with the sketch tools, the color, and the width slider.

- The **Sketches** tab opens in the Metadata Pane.
- If the micrograph has no sketch layer yet, “Sketch Layer 1” is created for you.

In a shared project, you need permission to edit the micrograph to sketch on it (Section 9.5.3).

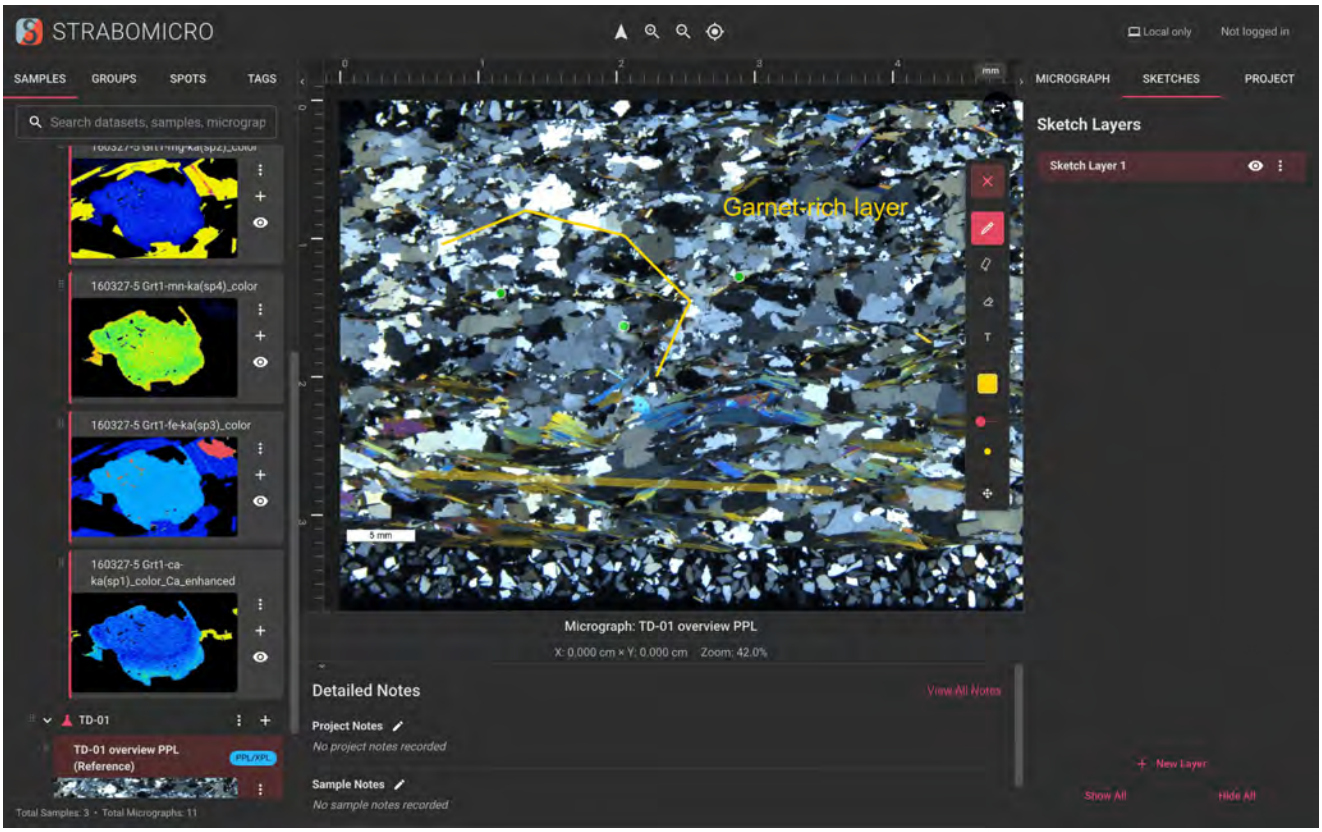


Figure 86. Sketch mode: pen and marker strokes and a text label on a sketch layer, the sketch toolbar on the right of the viewer, and the Sketches tab in the Metadata Pane.



Figure 87. The Sketch Mode button in the drawing toolbar (Section 4.6).

8.2.2 Exiting Sketch Mode

To exit sketch mode and return to normal operation:

- Click **Exit Sketch Mode (Esc)** in the sketch toolbar
- Press the Escape key

All sketches remain visible after exiting sketch mode, but you cannot draw new strokes until you re-enter sketch mode.

8.3 Sketch Tools

Four drawing tools are available in sketch mode (Figure 88). Each tool is optimized for different annotation tasks.

8.3.1 Pen Tool

Keyboard shortcut: 1

The Pen tool creates precise, thin strokes ideal for detailed annotations and tracing features.

- **Stroke width:** the width set with the slider (default 3 pixels)
- **Opacity:** 1.0 (fully opaque)
- **Best for:** Outlining grain boundaries, tracing fractures, detailed markup

How to use:

1. Select the Pen tool by clicking its icon or pressing 1
2. Click and drag on the micrograph to draw
3. Release the mouse button to complete the stroke

8.3.2 Marker Tool

Keyboard shortcut: 2

The Marker tool creates thick, semi-transparent strokes that work like a highlighter pen.

- **Stroke width:** three times the width set with the slider
- **Opacity:** 0.4 (semi-transparent)
- **Best for:** Highlighting regions of interest, emphasizing features, drawing attention to areas

How to use:

1. Select the Marker tool by clicking its icon or pressing 2
2. Click and drag to highlight areas on the micrograph
3. The semi-transparent nature allows the underlying image to remain visible

8.3.3 Eraser Tool

Keyboard shortcut: 3

The Eraser tool removes strokes and text from the current sketch layer.

- **Deletion mode:** Deletes entire strokes (not partial segments)
- **Visual feedback:** Strokes highlight when the eraser hovers over them
- **Works on:** pen and marker strokes and text in the active layer

How to use:

1. Select the Eraser tool by clicking its icon or pressing `3`
2. Click on any stroke to delete it entirely
3. Alternatively, click and drag across multiple strokes to delete them in sequence

Note: The eraser deletes complete strokes. If you need to remove only part of a stroke, delete the entire stroke and redraw the portion you want to keep.

8.3.4 Text Tool

Keyboard shortcut: `4` or `T`

The Text tool allows you to place text annotations directly on the micrograph.

- **Placement:** Click to position text at any location
- **Editing:** Text can be repositioned by dragging after creation
- **Color:** the current sketch color
- **Size:** while the Text tool is selected, the width slider becomes **Font Size** (8 to 72 pixels, default 24)

How to use:

1. Select the Text tool by clicking its icon or pressing `4` (or `T`)
2. Click on the micrograph where you want to place the text
3. An input field appears. Type your text and press `Enter` to place it (`Shift+Enter` starts a new line; `Esc` cancels)
4. The text is placed at the clicked location

To reposition text:

- With the Text tool active, click and drag existing text to move it

To edit existing text:

- Double-click on existing text to open the edit input field
- Modify the text and press Enter to confirm changes

8.4 Color and Width Controls

The sketch toolbar provides controls for customizing the appearance of your annotations (Figure 89).

8.4.1 Color Picker

The color swatch in the toolbar displays your current drawing color (red by default). Click it to open the **Stroke Color** picker and choose any color from the spectrum. The color applies to pen strokes, marker strokes and text.

The color picker closes automatically when you click outside of it, or you can click the swatch again to dismiss it.

8.4.2 Width Slider

The **Stroke Width** slider sets the width for the Pen (and three times that for the Marker).

- **Range:** 1 to 50 pixels (default 3)
- **Preview:** a preview shows the current width and color

Adjust the slider before drawing to set the width for subsequent strokes. Existing strokes are not affected by width changes.

8.5 Layer Management

Each micrograph can have multiple sketch layers, allowing you to organize annotations by purpose. Layers are managed through the **Sketches** tab in the right Properties panel (Figure 90).

8.5.1 Accessing Layer Management

1. Select a micrograph in the Sample Tree (left panel)
2. In the right Properties panel, click the **Sketches** tab
3. The panel displays all sketch layers for the current micrograph

8.5.2 Creating a New Layer

1. Click **New Layer** in the Sketches panel (or **Create First Layer** when the micrograph has none)
2. A new layer named “New Sketch Layer” is created
3. The new layer becomes the active layer for drawing

8.5.3 Selecting the Active Layer

Click on a layer name in the list to make it the active layer. All new drawing operations will be added to the active layer. The active layer is highlighted in the list. You cannot draw on a hidden layer; the toolbar says “Layer is hidden. Show it to draw.”

8.5.4 Layer Visibility

Each layer has an eye icon indicating its visibility status:

- **Eye icon visible:** Layer is shown on the micrograph
- **Eye icon hidden/crossed:** Layer is hidden
- Click the eye icon to toggle visibility

Quick visibility controls:

- **Show All:** Click to make all layers visible
- **Hide All:** Click to hide all layers

8.5.5 Renaming a Layer

To give a layer a descriptive name:

1. Double-click on the layer name in the list
2. The name becomes editable; type the new name
3. Press Enter or click outside to confirm the change

You can also choose **Rename** in the layer's menu (**...**).

Tip: Use descriptive names like "Grain boundaries", "Teaching notes", or "Draft annotations" to keep your layers organized.

8.5.6 Deleting a Layer

To delete a layer and all its contents:

1. Click the menu button (**...**) next to the layer name
2. Select **Delete**

Warning: Deleting a layer immediately removes all strokes and text on that layer, without asking. It can be undone with Undo (`Cmd+Z` on macOS, `Ctrl+Z` on Windows/Linux).

8.6 Undo and Redo

The sketch system supports full undo and redo functionality, integrated seamlessly with the main application's undo system.

8.6.1 Undo

- **macOS:** Press `Cmd+Z`
- **Windows/Linux:** Press `Ctrl+Z`

Undo reverses the most recent action, including:

- Drawing a stroke (pen or marker)
- Deleting a stroke with the eraser
- Adding text
- Deleting text
- Moving text
- Creating or deleting layers

8.6.2 Redo

- **macOS:** Press `Cmd+Shift+Z`
- **Windows/Linux:** Press `Ctrl+Shift+Z`

Redo restores an action that was previously undone.

Note: Undo and redo work across sketch and spot operations in one history (the last 50 steps). For example, you can undo a sketch stroke, then undo a spot creation.

8.7 Exporting with Sketches

Sketches are included in image exports:

- **One micrograph:** click **Export Micrograph...** at the top of the Metadata Pane. Under **Sketch Layers**, choose which layers to include (**All** / **None**).
- **Several micrographs:** in `File > Export Images...`, check **Visible sketch layers**.

Choose JPEG, PNG or SVG (Section 3.8). Exports are made at the micrograph's full resolution. In SVG, sketches stay editable vector shapes.

Tip: To export only the sketches on a transparent background, uncheck **Micrograph image** (and the other image options) and choose PNG.

8.8 Keyboard Shortcuts Summary

Table 4 summarizes all keyboard shortcuts for the sketch overlay system.

Table 4. Sketch Overlay Keyboard Shortcuts

Action	macOS	Windows/Linux
Exit sketch mode	`Escape`	`Escape`
Pen tool	`1`	`1`
Marker tool	`2`	`2`
Eraser tool	`3`	`3`
Text tool	`4` or `T`	`4` or `T`
Undo	`Cmd+Z`	`Ctrl+Z`
Redo	`Cmd+Shift+Z`	`Ctrl+Shift+Z`
Place text	`Enter`	`Enter`

8.9 Tips and Best Practices

8.9.1 Organizing Your Annotations

- **Use separate layers for different purposes:** Create distinct layers for teaching notes, draft annotations, and final markup

- **Name layers descriptively:** Names like “Grain boundaries”, “Fracture traces”, or “Student questions” help you find annotations quickly
- **Use Hide All before presentations:** Hide all sketch layers, then selectively show only the layers relevant to your presentation

8.9.2 Choosing the Right Tool

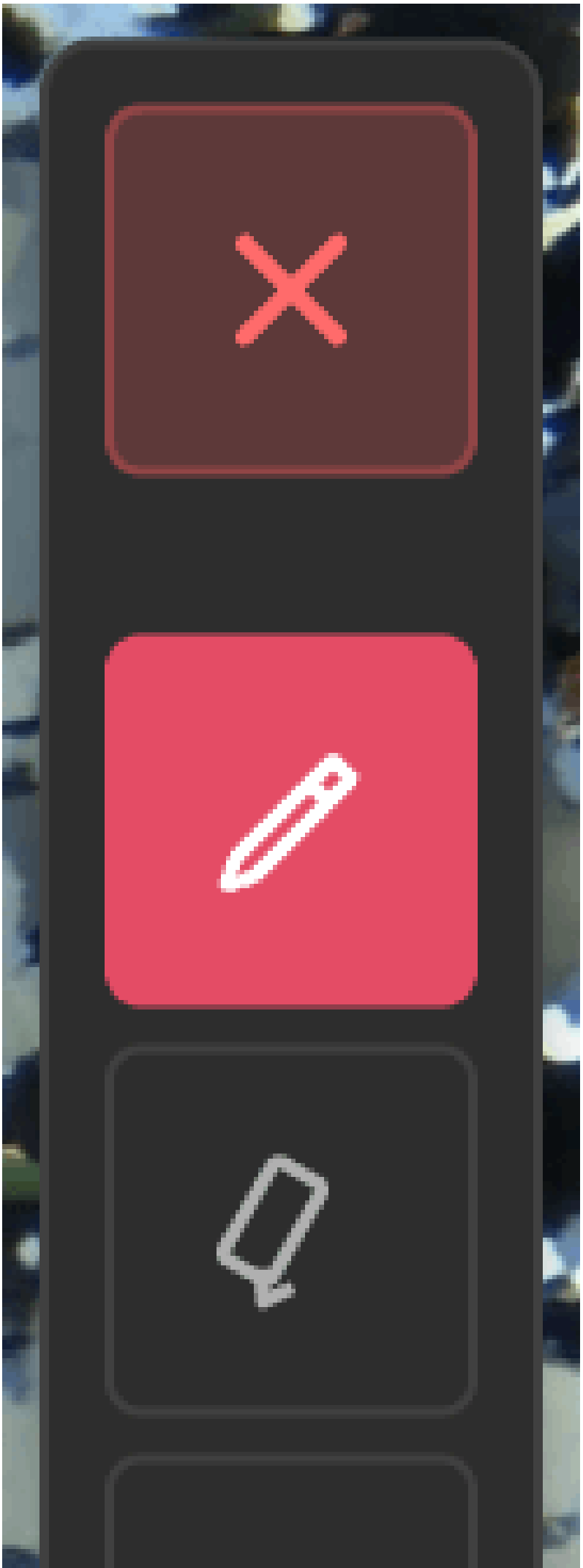
- **Pen tool:** best for precise work, such as tracing grain boundaries, marking small features, or detailed annotations
- **Marker tool:** best for highlighting, such as drawing attention to regions or emphasizing features in presentations
- **Text tool:** best for labels and notes, such as mineral names, measurement values, or reminders

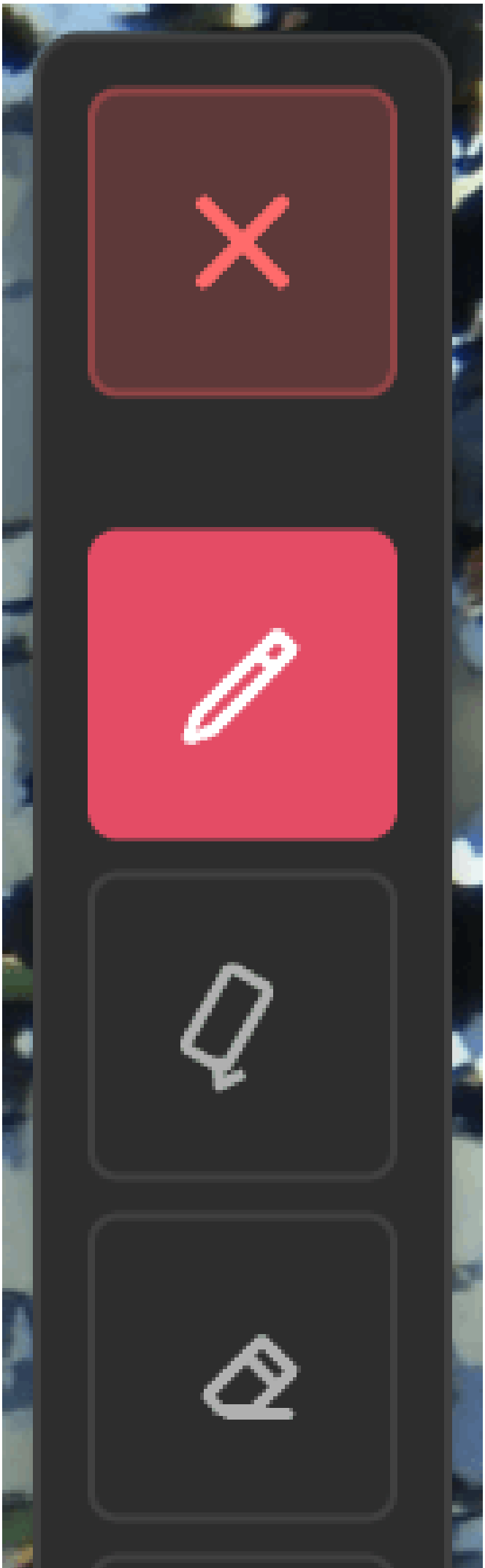
8.9.3 Export Strategies

- **For presentations:** export the micrograph with the sketch layers you need
- **For different audiences:** create separate exports with different layer combinations, one for students and another for colleagues
- **For overlay creation:** Export sketches only (without micrograph) as PNG with transparency, then composite in presentation software

8.9.4 Workflow Integration

- **Draft before finalizing:** Use sketches to draft polygon boundaries before creating formal spot annotations
- **Review workflow:** in a shared project, collaborators can add sketch layers for discussion before formal data entry
- **Teaching workflow:** Create a “Teaching” layer on frequently-used micrographs that can be shown or hidden as needed





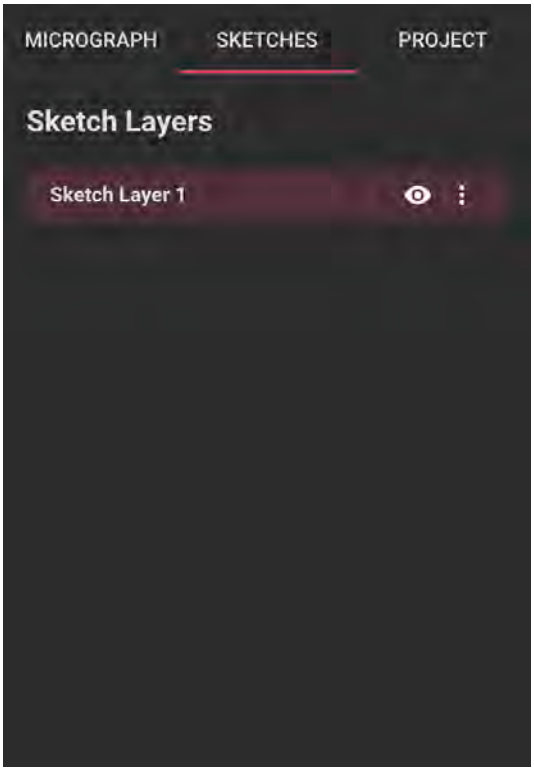


Figure 90. The Sketches tab in the Properties panel showing layer management controls.

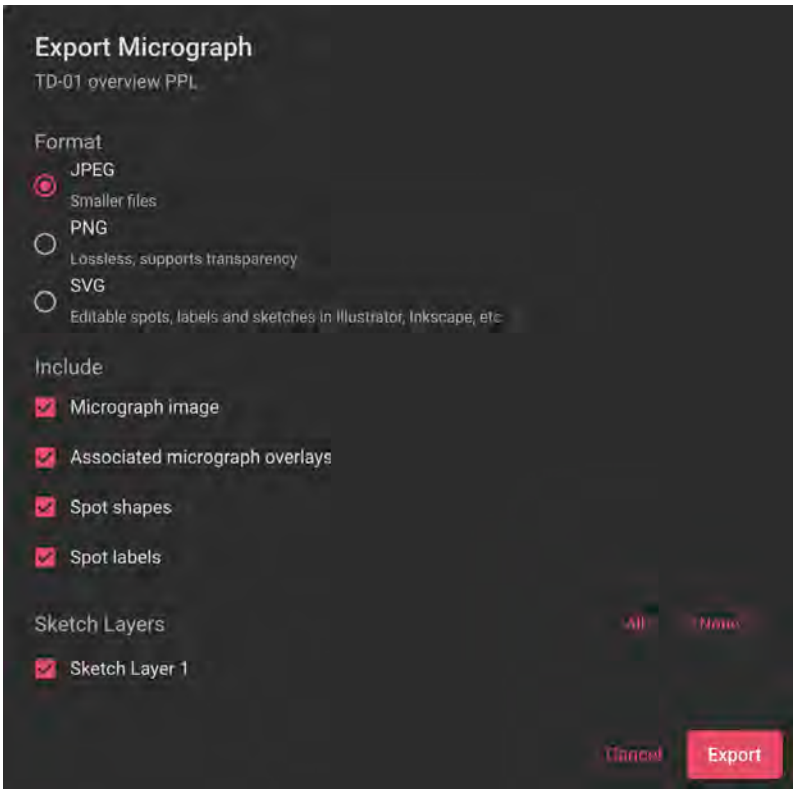


Figure 91. Choosing sketch layers in the Export Micrograph dialog.

9 Sync and Collaboration

A project can stay on your computer only, or be **synced** with StraboSpot. A synced project is kept both on your computer and on StraboSpot.org:

- **Backup:** StraboSpot keeps a copy of the project and its history.
- **Your other computers:** download the project on another computer; changes made on one reach the others.
- **Collaboration:** invite colleagues; everyone works on the same project and sees each other's changes within a second or two.

You keep working on your own computer: a synced project works offline, and your changes are sent when the connection is back. Projects kept on this computer only work exactly as before and never need an account.

Which micrographs you show or hide is your own view and is not synced; opacity and everything else in the project is shared (Section 5.10).

Version requirement: sync and collaboration need StraboMicro 2.0.55 or later on every computer that uses the project. Make sure your collaborators have updated (Section 2.7). An older version can lose newer information in a synced project.

9.1 Turning On Sync

You need a StraboSpot account and must be signed in (Section 2.5).

9.1.1 For a New Project

In **New Project**, choose **On this computer and synced to StraboSpot** under **Where to keep this project** (Section 3.1). A new synced project starts with **Sync automatically**.

9.1.2 For an Existing Project

Choose `File > Upload to Strabo Server...` (`Cmd+Shift+U` / `Ctrl+Shift+U`), or click **Local only** in the header and then **Sync this project…**. The **Sync this project to StraboSpot** dialog shows:

- The size of the first upload ("About *x* to upload. You can keep working while it uploads.").
- The sync mode: **Sync automatically** ("Changes go up about a second after you finish an edit.") or **Sync when I click** (after the first upload, nothing leaves this computer until you click **Sync Now**).
- Micrographs that are not finished yet (missing a scale, location or instrument details). You can sync now and finish them later; until then collaborators see them marked incomplete, and the StraboSpot website does not show a micrograph without a location on its parent.
- Micrographs that have no image file on this computer. StraboSpot would get them without an image; if another copy of the project still has the images, sync that copy instead.

Click **Start Syncing**. StraboMicro reopens the project as a synced project and uploads it in the background; the header shows the progress ("Uploading 40%"). You can keep working. After the first upload, only your changes are sent.



Figure 92. Turning on sync for a project.

9.1.3 Several Projects at Once

The first time you sign in after updating to version 2.0.55, **What's new: sync** lists the projects on this computer. Check the ones to sync, choose the mode, and click **Sync Selected**; they upload one at a time in the background while you work (a note at the bottom left shows the progress). **Not now** closes the dialog for good; you can sync any project later.

9.1.4 A Project That Is Already on StraboSpot

If a project on your computer was uploaded to StraboSpot with an earlier version, StraboMicro asks once, when you open it while signed in: **This project is also on StraboSpot**. Choose **Sync automatically**, **Sync when I click**, or **Keep on this computer only**. If your copy and the StraboSpot copy differ, **This copy differs from the one on StraboSpot** asks which to keep:

- **Use my copy:** StraboSpot gets the version on this computer, including anything you deleted here.
- **Use the StraboSpot copy:** this computer's copy is replaced. The replaced version is kept (in Version History, or in the folder `StraboMicro2Data/_replaced`).

9.2 The Sync Status Chip

The chip in the header shows what sync is doing for the open project. Click it for details and actions.

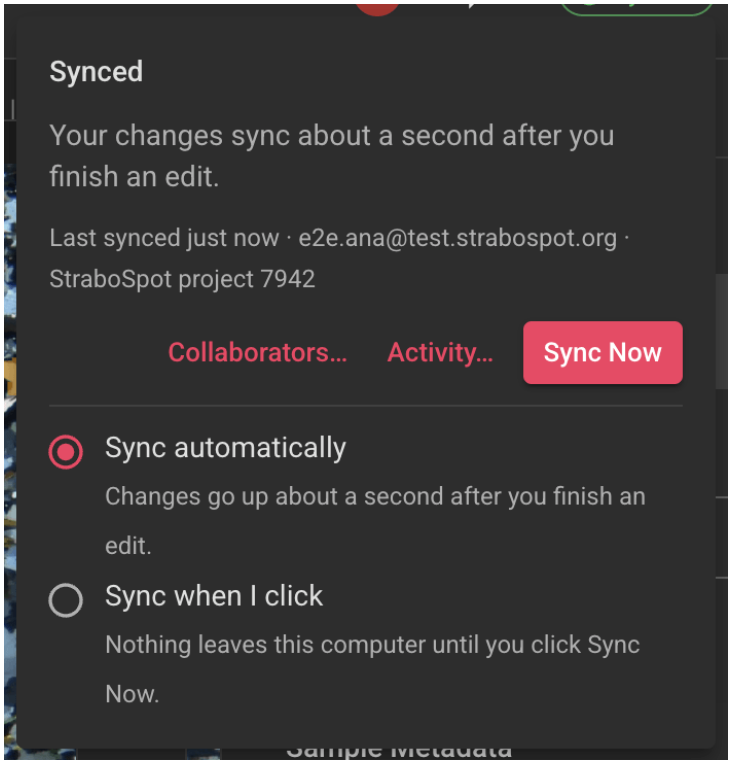


Figure 93. The sync status chip and its popover.

Chip	Meaning
Local only	The project is on this computer only. The popover offers **Sync this project…**.
Uploading *N*%	The first upload is running.
Syncing…	Changes are being sent or received.
Synced	Everything is up to date.
Manual · *N* to sync	In Sync when I click mode: your changes wait for **Sync Now**.
… · *N* incoming	Changes from others (or your other computer) are waiting on StraboSpot. **Sync Now** brings them in.
Downloading…	Images added by others are being downloaded.
Offline	StraboSpot cannot be reached. Your changes are kept and sent when the connection returns.
Log in to sync	Sign in (as the account the project belongs to) to sync. Your changes are kept until then.
***N* needs your decision**	Some changes conflict; see Section 9.4. Everything else keeps syncing.
Server unavailable	StraboSpot did not answer as expected; StraboMicro tries again.

The popover also shows when the project last synced, the account, and these buttons: **Collaborators…**, **Activity…**, **Review decisions…** (when decisions are waiting) and **Sync Now**. At the bottom you can switch between the two modes at any time.

9.2.1 Sync Modes

- **Sync automatically:** your changes are sent about a second after you finish an edit, and changes from others arrive by themselves. If you are in the middle of an edit (a dialog is open, or you are typing), incoming changes wait until you finish ("Ana made 2 changes; they'll appear when you close this dialog").
- **Sync when I click:** nothing is sent or received until you click **Sync Now** (in the chip's popover, or `File > Sync to Strabo Server...`). The chip counts your changes and the incoming ones. When you open the project and changes are waiting, **Changes waiting on StraboSpot** offers **Sync Now** or **Work Offline**.

Sync Now always saves, sends your changes, then brings in the others'.

9.2.2 Working Offline

Keep working: your changes are saved on your computer and wait. The chip shows **Offline** and how many changes are queued; in automatic mode they are sent as soon as the connection is back. Your name in the header shows "· offline" while StraboSpot cannot be reached; you stay signed in.

9.2.3 Signing Out

If you sign out while a synced project has changes that have not been sent, **Log out of StraboSpot?** offers **Sync and log out**. **Log out anyway** keeps the changes on this computer; they are sent the next time you sign in with the same account.

9.2.4 When Your Login Runs Out

A login lasts 30 days from the last time you used StraboMicro (Section 2.5). If it runs out while a synced project is open, a notice at the bottom left says "You were logged out of StraboSpot. Log in as *your email* to keep syncing this project; your changes are kept on this computer until then." Click **Log in** to sign in again; the chip shows **Log in to sync** until you do. Your changes wait on your computer and are sent as soon as you are signed in.

9.3 Your Other Computers

`File > Open Remote Project...` (signed in) lists your projects on StraboSpot, including projects shared with you, most recently changed first. Each row shows when the project changed, whether you have a copy on this computer, whose project it is, and how many people are in it.

- **Open:** a copy is already on this computer.
- **Download:** download a synced copy. Choose **Sync automatically** or **Sync when I click** above the list. You can close the window during a large download; the project appears in Recent Projects when it is done.

Pending invitations are listed at the top (Section 9.5). Projects uploaded with earlier versions are listed too; downloading one connects it to sync.

A synced copy belongs to the account that downloaded it. If someone else signs in on the same computer, StraboMicro says **This copy belongs to *name*** and offers to sign in as that person; the other account can download its own copy.

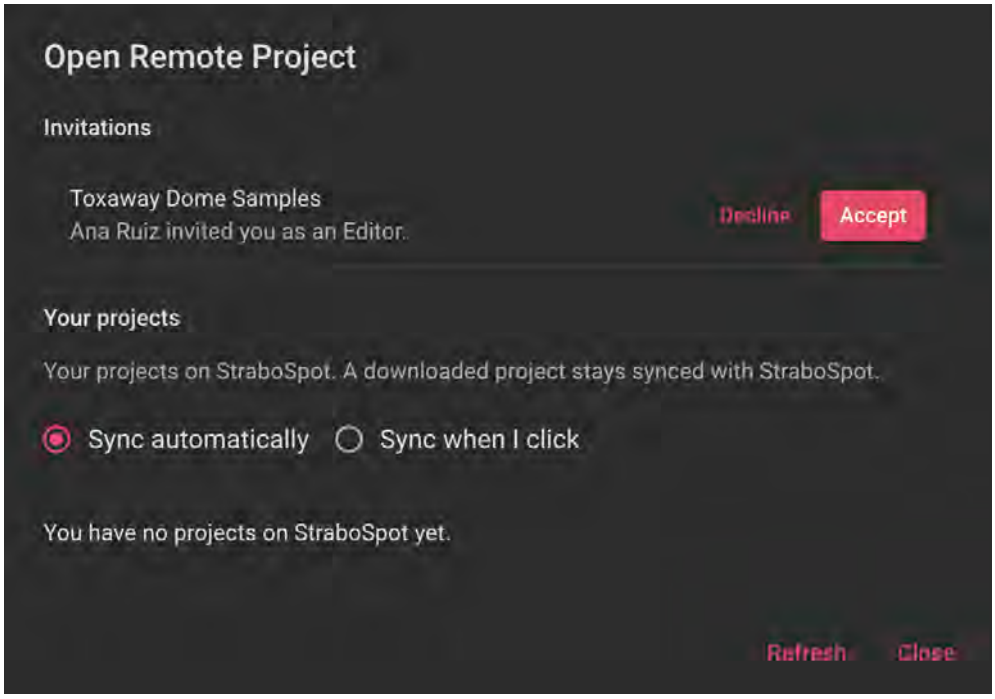


Figure 94. Open Remote Project, with an invitation at the top.

9.4 When Changes Conflict

Most changes combine without any question: if you change a spot's notes and a collaborator changes its color, both changes are kept. StraboMicro asks only when the same thing was changed in two places, or when one side deleted something the other changed. A note at the bottom left of the window ("1 sync change needs your decision") and the sync chip say so. Click **Review** to open **Sync needs your decision**.

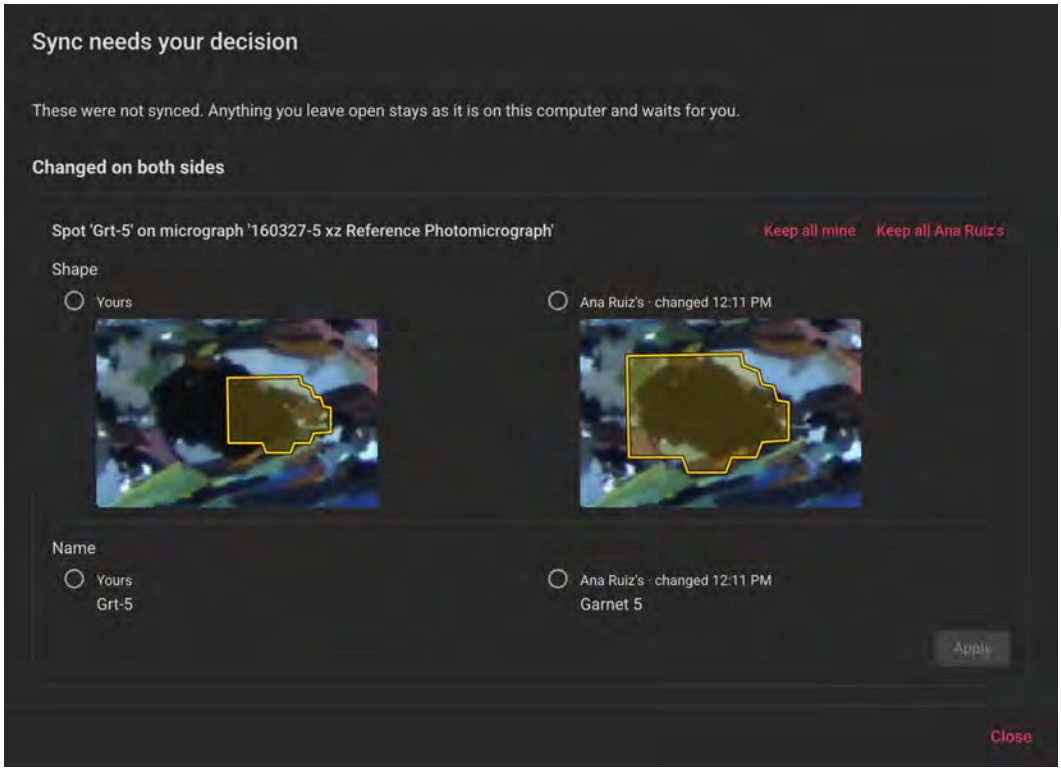


Figure 95. Sync needs your decision: a spot's shape and name changed on both sides, shown side by side. The other version is headed with the name of the person who changed it and when.

- **Changed on both sides:** each changed field is shown with **Yours** and the other version, headed with the name of the person who changed it and when (for example, **Fred Smith's · changed 10:21 AM**), so you know who to talk to. A change made with your own account on another computer is headed **You, on another computer**. Choose per field, or use **Keep all mine** / **Keep all Fred Smith's** (**Keep all theirs** when several people changed the item), then click **Apply**. Spot shapes and micrograph placements are shown as pictures.
- **Someone deleted something you changed** ("Fred Smith deleted …"): **Delete it**, or **Restore with my changes**.
- **You deleted something others changed** (the names of who changed it are shown): **Keep deleted**, or **Bring back with their changes**.
- **Not accepted by the server:** the reason is shown (for example, your role does not allow the change). **Discard my change** returns the item to the version on StraboSpot.

Each answer is applied and synced at once. You do not have to answer everything: anything you leave open stays as it is on your computer, and everything else keeps syncing. Choosing "theirs" in a conflict can be undone.

9.5 Collaborators and Roles

9.5.1 Inviting People

1. Choose `File > Collaborate...` (or **Collaborators…** in the sync chip's popover). For a project kept on this computer only, sync is turned on first.

2. Under **Invite by email**, enter the person's **Email address** and choose a role.
3. Click **Invite**. They need a StraboSpot account, and receive an email with the invitation.

The **Collaborators** dialog lists everyone in the project with their role; invitations not yet answered are marked **Invited** or **Declined**. The owner can change a member's role, **Remove…** a member, and **Withdraw…** an invitation. A removed person keeps their own copy, and changes they had not synced yet come to the owner for review (Section 9.8).

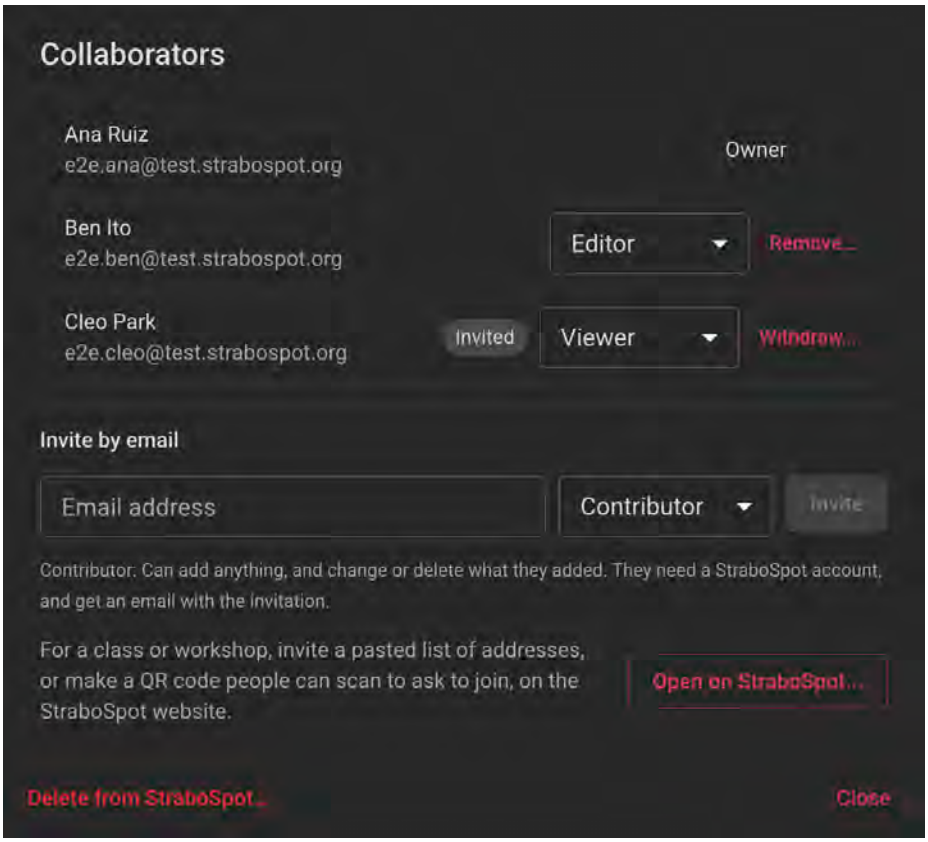


Figure 96. The Collaborators dialog.

9.5.2 Inviting a Class or Workshop

For a larger group, the owner can use the Collaborators page on the StraboSpot website: in `File > Collaborate...`, click **Open on StraboSpot…**, and log in if asked. It works on the same list as the app, and offers two more ways to invite people:

- **Paste a list:** paste up to 100 email addresses at a time, from an email or a spreadsheet column, and click **Send Invitations**. The page reports what happened to each address. People with no StraboSpot account are listed so you can ask them to create one.
- **Join link:** click **Create Join Link** to get a QR code and a short address. You choose the role and how long it stays open. **Show Full Screen** is for a projector, and **Download PDF** makes a one-page handout with your own Title and Details. Anyone with the link can create an account if needed and click **Ask to Join**. They appear under **Waiting for you**, where you click **Approve**, **Deny** or **Approve All**. Nobody joins without your approval. **Revoke Link** stops the link, and people who already joined stay until you remove them.

9.5.3 Roles

Role	Can
Owner	Everything, including inviting and removing people and deleting the project from StraboSpot.
Editor	Add, change and delete anything in the project.
Contributor	Add anything anywhere, but change or delete only what they added (and delete something only if everything in it is theirs). Cannot change project settings.
Viewer	See everything and chat, but not change anything.

Things your role does not allow are disabled or read-only, with a short explanation such as "View only. Added by Ana; only they or an Editor can change it."

9.5.4 Answering an Invitation

When someone invites you, StraboMicro shows **You have an invitation** (also later as a chip in the header, and at the top of `File > Open Remote Project...`; on the website, at the top of My StraboMicro Data). Click **Accept** to join: the project is downloaded and kept in sync with the other collaborators. **Decline** refuses it; **Later** keeps it waiting.

9.6 Seeing Who Is Working

In a synced project, StraboMicro shows the other people who have the project open:

- **Header:** a colored badge with each person's initials; faded when they have been away for a while. Hover a badge to see what they are doing ("Ana Ruiz, viewing Overview").
- **Project tree, spot list and Metadata Pane:** badges on the micrograph a person is viewing, and an "editing" mark on what they are editing.
- **Edit dialogs:** a note at the top when someone else is editing the same item: "Ana Ruiz is editing this spot right now. You can still edit; if you both change the same field you'll be asked which to keep."

Nothing is locked: two people can edit at the same time.

9.7 Project Chat

Each shared project has a chat. Click the chat button (speech bubble) in the header, next to the sync chip; it appears in a synced project with at least one other member, and shows the number of unread messages. Everyone in the project can chat, Viewers included.

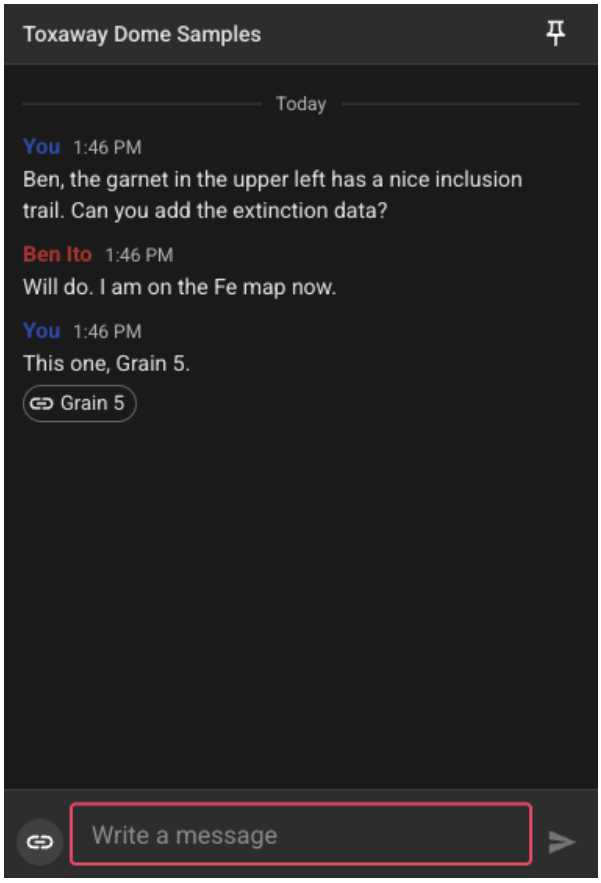


Figure 97. The chat window, with a message linked to a spot.

- The chat opens in its own window, which you can place anywhere. **Keep on top** keeps it above the StraboMicro window.
- Press `Enter` to send, `Shift+Enter` for a new line.
- **Linking to a spot or micrograph:** select it in the main window, then click the link button ("Link the selected spot or micrograph"). The message shows its name; anyone can click it to go to that spot or micrograph. A spot link opens the spot's micrograph and zooms in so the spot fills about a third of the view.
- Web addresses in messages open in your browser.
- Offline, messages wait and are sent when the connection is back.
- You can delete your own messages (hover a message to see the delete button); the owner can delete any message.
- **Notifications:** when StraboMicro is in the background, a notification shows new messages. Turn them off in `File > Preferences... > Chat notifications`. The number of unread messages also shows on the StraboMicro icon (Dock on macOS, taskbar on Windows, launcher on Linux).

9.8 Activity and Restoring

`View > Activity` (or **Activity…** in the sync chip's popover) opens the **Activity** panel beside the Metadata Pane. It lists:

- **Here now:** who has the project open.
- Changes that have not reached your copy yet, with **Sync Now**.
- **Who changed what**, newest first ("Ana Ruiz added spot 'OI-3' to micrograph 'Overview' "). Click a change about a spot or micrograph to go to it (a spot is zoomed in, as with chat links). **Show older** loads earlier changes.
- **Restore** next to deleted items brings them back. Owners and Editors can restore anything; Contributors can restore what they deleted.
- **Full history on StraboSpot…** opens the project's history page on the website, where you can filter changes by person and date and download the project as it was at any earlier time.

9.8.1 Changes Waiting for the Owner's Review

When a member is removed, or their role changes, changes they had not synced yet are sent to the owner instead of into the project. The owner sees a count on the sync chip and in the Activity panel; **Review…** opens **Changes waiting for your review**, where each change can be accepted (it becomes the owner's own edit, which can be undone) or discarded.

9.9 Leaving, Removal and Deleting a Project

- **Leaving:** in `File > Collaborate...`, a member can click **Leave Project…**. Your unsynced changes are sent first; then choose **Keep a separate copy on this computer (it no longer syncs)** or **Remove it from this computer**.
- **Being removed:** if the owner removes you, StraboMicro tells you the next time the project syncs (**Removed From the Project**). Your copy becomes your own separate project on this computer, and changes you had not synced are sent to the owner for review. **Delete This Copy** removes it; **OK** keeps it.
- **Deleting from StraboSpot (owner):** in `File > Collaborate...`, **Delete from StraboSpot…** deletes the project for everyone; the other members' copies become separate copies. Choose whether to keep a copy on this computer, type the project's name to confirm, and click **Delete from StraboSpot**. StraboSpot keeps the project for 30 days; until then the owner can restore it from My StraboMicro Data on the website.
- **Removing a copy from one computer:** `File > Close Project...` on a synced project removes only this computer's copy (Section 3.6).

9.10 Opening Projects from the Web Viewer

Projects on StraboSpot can be viewed in the web viewer (Section 3.10). Its **Open in StraboMicro** button opens the project in StraboMicro on your computer (if StraboMicro is not installed, use **Don't have StraboMicro? Download it**). StraboMicro starts if needed and shows **Open in StraboMicro**:

- For your own project, or one you are a member of (signed in): **Open** your copy, or **Download** it as a synced copy.

- Otherwise: **Download & Open** imports a copy of the published project, kept on this computer only.

If the project is not available (deleted, not finished uploading, or a wrong link), StraboMicro says **Project Not Available**.

10 Troubleshooting and FAQs

10.1 Getting Help

If you experience a problem with StraboMicro, please use `Help > Send Error Report...`. Describe what you were doing and what went wrong; the report automatically includes the application's logs, which are essential for finding the cause. To look at the logs yourself, use `Help > View Error Logs...`, which can also copy them or start an email to support.

For other support resources, refer to Section 1.5.

10.2 Common Issues and Fixes

1. **StraboMicro Crashes and Fails to Launch:** If StraboMicro crashes and then fails to open, first use `Help > Send Error Report` (or email us, see Section 1.5) so we can find the cause. If you are asked to clear the application's cached data, delete only the `tile-cache` folder in the application's settings folder:

   - **macOS:** `~/Library/Application Support/strabomicro2/tile-cache`
   - **Windows:** `%APPDATA%\strabomicro2\tile-cache`
   - **Linux:** `~/.config/strabomicro2/tile-cache`

   StraboMicro rebuilds the tiles the next time each micrograph is shown.

   Important: Do **not** delete folders inside `Documents/StraboMicro2Data`. Each folder there *is* a project, with its `project.json` and its images. Deleting one deletes that project from your computer.

2. **An Image Shows Seams, Missing Areas or the Wrong Picture:** use `Tools > Rebuild Tile Cache...` (Section 7.11). It rebuilds the display tiles of every micrograph in the project without changing your data.

3. **A Project Won't Open or Looks Wrong:**

   - Use `File > View Version History...` to restore an earlier version (Section 3.5).
   - For a synced project, the project is also on StraboSpot: `File > Close Project...` removes this computer's copy, and `File > Open Remote Project...` downloads it again. Send changes that have not been synced first, if you can.
   - Send an error report.

4. **Associated Micrographs Look Blurry:** StraboMicro loads more detail as you zoom in. Zoom in and wait a moment for the full-resolution tiles to load ("Loading tiles..."). Also check that the original image had full resolution when it was added.

5. **Spots Are Not Visible:**

   - If the spots belong to an associated micrograph, check that the micrograph is not hidden (its eye button in the project tree).

- To see the spots of associated micrographs on their parent, turn on `View > Show Recursive Spots`. To see the spots of the micrographs above it, turn on `View > Show Parent Spots`.
- A spot hidden under a larger one: right-click there and use **Select Spot Here** (Section 5.17).
- `View > Hide Spot Labels` hides only the labels, not the spots. Choose **Show Original Spot Labels** to show the names again.
- With `View > View Spots by Mineral Color`, spots without a mineral color may be hard to see; switch to **View Spots by Spot Color**.

6. **A Synced Project Does Not Sync:** click the sync chip in the header; it says what is wrong (Section 9.2):
   - **Offline:** check your internet connection. Your changes are kept and sent when the connection returns.
   - **Log in to sync** or **Different account:** sign in as the account the project belongs to.
   - **Needs your decision:** some changes conflict; click **Review decisions…** (Section 9.4).
   - **Manual · *N* to sync:** the project is set to Sync when I click; click **Sync Now**.
7. **A Collaborator Does Not See My Changes:** check that both of you have version 2.0.55 or later, that your sync chip says **Synced**, and that their project is set to Sync automatically (or that they click **Sync Now**).
8. **A Menu Item Is Disabled or a Field Is Read-Only:** in a shared project, your role may not allow the change (Section 9.5.3). A note in the dialog says why.

10.3 Frequently Asked Questions (FAQs)

Do I have to update StraboMicro by hand?

No. StraboMicro checks for new versions and tells you when one is available. Click **Download**, then **Restart Now** (or **Later**, and the update is installed when you quit). See Section 2.7.

Where is my project data stored?

Each project is a folder in the `StraboMicro2Data` folder in your Documents folder; synced projects are in its `accounts` folder. A project's folder holds its images and a `project.json` file with all metadata and annotations. Use `File > Export as .smz...` for a single-file copy, and sync for a backup on StraboSpot.

Can I recover a previous version of my project?

Yes. Every save creates a version on your computer. Use `File > View Version History...` to see the versions and restore one. For a synced project, deleted items can also be restored from the Activity panel, and the StraboSpot website keeps the project's full history.

How do I change between dark and light themes?

Go to `View > Theme` and choose **Dark**, **Light**, or **System** (follow your operating system).

What image formats are supported?

TIFF (including very large files, shown with tiles, 16-bit images and images with a color table), JPEG, PNG and BMP.

Can I work offline?

Yes. All analysis and annotation works offline, and synced projects keep your changes until the connection returns. An internet connection is needed only for:

- Signing in, syncing and collaboration, and chat
- Opening remote or shared projects
- Linking samples from StraboSamples, and the instrument database
- Downloading the FastSAM grain detection model (once)
- Sending error reports, checking for updates, and opening this manual from the Help menu

How do I export my micrographs with annotations?

- `File > Export Images...` exports several micrographs in one ZIP file.
- The **Export Micrograph...** button at the top of the Metadata Pane exports the micrograph you are viewing.
- Choose SVG to keep spots, labels and sketches as editable vector shapes.

See Section 3.8.

What's the difference between spots and sketches?

- **Spots:** scientific annotations with structured data (mineralogy, fabrics, deformation features and more). Spots are part of the project's data on StraboSpot and appear in reports and searches.
- **Sketches:** freeform drawing (pen, marker, text) for informal markup, teaching or highlighting. They have no structured data.

How do I use keyboard shortcuts in Quick Edit?

- **Mineral keys** (for example `Q` for Quartz): assign the mineral and go to the next spot
- **1 to 9:** apply the Quick Spot Preset bound to that key
- **Space or Enter:** mark the spot reviewed and go to the next one
- **Tab:** next unclassified spot; **Backspace:** previous spot
- **Arrow keys, [and]:** previous or next spot

- **Delete:** delete the spot
- **Esc:** end Quick Edit

See Section 7.3.

Can several people work on the same project at the same time?

Yes. Sync the project and invite your colleagues with `File > Collaborate...` (Section 9.5). Everyone works in their own copy of StraboMicro, and changes reach the others within a second or two. You can see who is working where, chat, and restore deleted items. If two people change the same thing, StraboMicro asks which version to keep. Everyone needs version 2.0.55 or later.

What is the difference between sharing a project and collaborating?

A **share code** gives someone their own independent copy of the project; their changes stay with them (Section 3.10.2). **Collaborating** means working on the same project together, with changes synced between everyone (Section 9.5).

Can I use StraboMicro without an account?

Yes. Projects kept on this computer only need no account. An account is needed for sync, collaboration, StraboSamples, and publishing projects on StraboSpot.org.

Why should I update StraboMicro?

Updates bring bug fixes, new features, performance improvements and security fixes. In a synced or shared project, everyone should use the same recent version: an older version may not understand information added by a newer one.

11 Appendices

11.1 Glossary of Terms

Abbreviations (Alphabetical)

- **ACOM** – Automated Crystal Orientation Mapping
- **ADF** – Annular Dark Field
- **AFM** – Atomic Force Microscopy
- **BSE** – Backscattered Electron
- **CBED** – Convergent Beam Electron Diffraction
- **CL** – Cathodoluminescence
- **ECCI** – Electron Channeling Contrast Imaging
- **EPMA** – Electron Probe Microanalysis (Electron Microprobe)
- **EBSD** – Electron Backscatter Diffraction
- **EDS** – Energy Dispersive X-ray Spectroscopy
- **EELS** – Electron Energy Loss Spectroscopy
- **FIB** – Focused Ion Beam
- **FSE** – Forescattered Electron
- **FTIR** – Fourier Transform Infrared Spectroscopy
- **IGSN** – International Generic Sample Number
- **HAADF** – High-Angle Annular Dark Field
- **IPF** – Inverse Pole Figure (e.g., IPF-X, IPF-Y, IPF-Z)
- **LACBED** – Large Area Convergent Beam Electron Diffraction
- **NBD** – Nano Beam Diffraction
- **PI** – Principal Investigator
- **PPL / XPL** – Plane Polarized Light / Cross Polarized Light
- **SAED** – Selected Area Electron Diffraction
- **SE** – Secondary Electron
- **SEM** – Scanning Electron Microscopy
- **STEM** – Scanning Transmission Electron Microscopy
- **TEM** – Transmission Electron Microscopy
- **TKD** – Transmission Kikuchi Diffraction
- **WDS** – Wavelength-Dispersive X-ray Spectroscopy

StraboMicro Application Terms

- **Associated Micrograph** – A micrograph placed on another micrograph (its parent)
- **Auto Spot Mode** – Placing spots without a dialog; each spot is named from a pattern
- **Collaborator** – A person a synced project is shared with, as Owner, Editor, Contributor or Viewer
- **Dataset** – A collection of related samples within a project
- **Local-only Project** – A project kept only on this computer (not synced)
- **Micrograph** – A digital image captured through a microscope
- **Overlay** – An associated micrograph placed on top of a reference image
- **Project** – The top-level container for all data in StraboMicro
- **Quick Spot Preset** – A saved set of spot appearance and geological data, applied in one step
- **Reference Micrograph** – A micrograph that is not placed on another; the base of a hierarchy
- **Sample** – A physical specimen containing one or more micrographs
- **Sibling (PPL/XPL pair)** – Two images of the same area, one PPL and one XPL, shown in the same place and toggled with `X`
- **Sketch Layer** – A transparent drawing layer for annotations
- **Spot** – A user-defined region of interest on a micrograph (point, line, or polygon)
- **Synced Project** – A project kept on this computer and on StraboSpot, where changes are exchanged automatically or when you click Sync Now
- **.smz File** – StraboMicro project archive format (ZIP-based), for export, import and sharing

11.2 Keyboard Shortcuts

On macOS the menu shortcuts use `Cmd`; on Windows and Linux they use `Ctrl`. The tables write `Cmd`. Single-key shortcuts (such as `V` or `X`) do not work while you are typing in a text field.

Menu Shortcuts

Shortcut	Action
`Cmd+N`	New Project
`Cmd+O`	Open Local Project (.smz)
`Cmd+S`	Save Project
`Cmd+Shift+E`	Export as .smz...
`Cmd+Shift+U`	Upload to Strabo Server... (Sync to Strabo Server... for a synced project)
`Cmd+E`	Edit Project
`Cmd+,`	Preferences...
`Cmd+Q`	Quit (macOS; `Ctrl+Q` on Linux; File > Exit on Windows)
`Cmd+Z`	Undo
`Cmd+Shift+Z`	Redo
`Cmd+Shift+G`	Grain Detection...
`Cmd+Shift+A`	Grain Size Analysis...
`Cmd+Shift+T`	StraboTools...
`Cmd+Shift+P`	Quick Spot Presets...
`Cmd+Shift+Q`	Quick Edit Spots...
`Cmd+Shift+B`	Edit Selected Spots...
`Option+Cmd+M`	Merge Selected Spots (`Cmd+M` minimizes the window)
`Cmd+/`	Split Spot with Line...
`Cmd+Shift+L`	Cycle Spot Labels (original, mineralogy, hidden)
`Cmd+Shift+O`	Show Overlay Outlines
`Cmd+Shift+R`	Show Recursive Spots
`Cmd+Shift+V`	Micrograph Visibility...
`Cmd+Shift+F`	Filter Spots...

Cut, Copy, Paste and Select All (`Cmd+X`, `Cmd+C`, `Cmd+V`, `Cmd+A`) work in text fields.

Micrograph Viewer

Shortcut	Action
`V`	Pan and Select
`P`	Point Spot tool
`L`	Line Spot tool
`G`	Polygon Spot tool
`M`	Measure Distance
`X`	Show the other image of a PPL/XPL pair

Shortcut	Action
`Scroll / Pinch`	Zoom toward the cursor
`Drag`	Pan (also while a spot tool is selected)
`Double-click`	Finish a line or polygon
`Shift+Drag`	Lasso-select spots
`Cmd+Click`	Add a spot to the selection, or remove it
`Esc`	Cancel geometry editing or a split line; end an auto spot run

Auto Spot Mode

Shortcut	Action
`1` to `9`	Make the next spots with the preset bound to that key
`Option+Click` (macOS), `Alt+Click` (Windows/Linux)	Open the New Spot dialog for this one spot, already filled in
`Esc`	End the run (the tool is turned off)

Sketch Mode

Shortcut	Action
`1`	Pen tool
`2`	Marker tool
`3`	Eraser tool
`4` or `T`	Text tool
`Enter`	Place the text being typed (`Shift+Enter` for a new line)
`Esc`	Cancel the text being typed; otherwise exit sketch mode

Quick Edit and Point Count

These keys work while the Quick Edit or Point Count toolbar is open (Section 7).

Shortcut	Action
Mineral key	Classify and go to the next item (keys set in Configure Shortcuts)
`1` to `9`	Apply the bound Quick Spot Preset (Quick Edit)
`Space` or `Enter`	Next item (Quick Edit: marks the spot reviewed)
`Tab`	Next unclassified item
`Backspace`	Previous item

Shortcut	Action
`Arrow keys`	Quick Edit: previous or next spot; Point Count: move through the grid
`[` and `]`	Quick Edit: previous or next spot
`Delete`	Quick Edit: delete the spot; Point Count: clear the point
`Shift+Drag`	Lasso-select, then press a mineral key to classify all
`Esc`	Clear the selection; otherwise close the toolbar

Project Tree

Click a dataset, sample or micrograph row in the Samples tab first.

Shortcut	Action
`Cmd+Up`	Move the item up among its siblings
`Cmd+Down`	Move the item down among its siblings
`Esc` (in the search box)	Clear the search

3-Point Registration

Shortcut	Action
`V`	Point tool (place points)
`P`	Pan tool
`R`	Reset all points
`Delete` / `Backspace`	Delete the selected point
`Enter`	Apply (with at least 3 point pairs)
`Esc`	Cancel

Note that in 3-Point Registration `V` places points and `P` pans, the reverse of the main viewer.

11.3 Data Schema Overview

Project Hierarchy

StraboMicro organizes data in a hierarchy:

```
Project
  |-- Dataset
  |     |-- Sample
  |           |-- Reference Micrograph
  |           |     |-- Spots (point, line, polygon)
  |           |     |-- Associated Micrograph
  |           |           |-- Spots
  |           |           |-- Associated Micrograph (any depth)
  |           |-- Reference Micrograph
  |-- Dataset
```

In the project file, all micrographs of a sample are kept in one list; an associated micrograph records its parent with `parentID` and its placement on the parent (offset and rotation, a point, or a 3-point affine transform).

- **Project**: name, dates, purpose of study, team members, area of interest, instruments used, GPS datum, magnetic declination, notes, the project's groups, tags and presets, and the order of its Custom User Data columns (`customUserDataColumns`).
- **Dataset**: a named group of samples.
- **Sample**: Sample ID, IGSN, location, sampling purpose, description, material type, notes, and its micrographs.
- **Micrograph**: the image, its scale and orientation, instrument and image information, placement on its parent, geological data, sketches, and its spots.
- **Spot**: name, color, opacity, geometry (point, line or polygon), geological data, notes, files, links, tags and Custom User Data (`customUserData`, header and value pairs kept as text).

Projects on Disk

Each project is a folder, named with the project's id, in the `StraboMicro2Data` folder in your Documents folder. It contains `project.json` (all metadata and annotations), the micrograph images, thumbnails, associated files and point count sessions. Synced projects are kept in `StraboMicro2Data/accounts/`. Image tiles and version history are kept in the application's settings folder (Section 2.4).

.smz File Format

An .smz file is a ZIP archive of one project, made by `File > Export as .smz...`:

```
<project id>/
  |-- project.json            all metadata and annotations
  |-- project.pdf             the project report
  |-- README.txt
```

```
|-- images/                  the micrograph images (JPEG)
|-- compositeThumbnails/     thumbnails with overlays
|-- associatedFiles/         files attached to micrographs and spots
|-- point-counts/            point count sessions
|-- tiles/<micrograph id>/   image tiles (WebP) and reduced copies
|-- tilesAffine/             tiles of micrographs placed by 3-point
                             registration
```

Sketches are stored as vector data in `project.json`. The tiles are included so that a project opens quickly and displays in the StraboSpot web viewer.

project.json Structure

`project.json` uses the same structure as the original StraboMicro, so projects move freely between the two. A shortened example:

```
{
  "id": "<project id>",
  "name": "Toxaway Dome Samples",
  "startDate": "...", "endDate": "...",
  "purposeOfStudy": "...",
  "gpsDatum": "WGS84",
  "date": "...", "modifiedTimestamp": "...",
  "datasets": [
    {
      "id": "<dataset id>", "name": "Dataset 1",
      "samples": [
        {
          "id": "<sample id>", "sampleID": "TD-01",
          "igsn": "...", "latitude": ..., "longitude": ...,
          "micrographs": [
            {
              "id": "<micrograph id>", "name": "TD-01 overview",
              "imageType": "Cross Polarized Light",
              "imageWidth": 6000, "imageHeight": 4000,
              "scalePixelsPerCentimeter": 2400,
              "instrument": { ... },
              "spots": [
                { "id": "<spot id>", "name": "Spot 1",
                  "geometryType": "point", "points": [ ... ],
                  "mineralogy": { ... } }
              ]
            }
          ]
        }
      ]
    }
  ],
```

```
  "groups": [ ... ],
  "tags": [ ... ]
}
```

Compatibility

StraboMicro 2 reads and writes the same project format as the original StraboMicro. When you open a .smz from the original application, its images are converted for fast display (TIFFs are converted, and images narrower than 2000 pixels are enlarged so that existing spot coordinates stay in place). The .smz file you opened is never changed. A BMP image kept by the original application is converted once to a PNG with the same pixels when the project opens, so that it can be displayed, exported and synced.

11.4 Licensing and Attribution

StraboMicro2 License

StraboMicro2 is released under the MIT License:

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Third-Party Attributions

StraboMicro2 incorporates the following open-source libraries and models:

Component	License	Description
Electron	MIT	Framework for cross-platform desktop applications.
React	MIT	Library for building user interfaces.
MUI	MIT	User interface components.
Zustand	MIT	State management.
Konva.js	MIT	2D canvas library for image display and drawing tools.
Sharp	Apache 2.0	Image processing: TIFF decoding, tile generation.
node-canvas	MIT	Image composition for exports and reports.
tiff	MIT	TIFF decoding.
FastSAM	Apache 2.0	Fast Segment Anything Model, used for AI grain detection. Developed by CASIA IVA Lab.
ONNX Runtime Web	MIT	Runs the FastSAM model on your computer.
OpenCV.js	Apache 2.0	Computer vision, used for OpenCV grain detection.
Turf	MIT	Geometry operations for merging and splitting spots.

Component	License	Description
polygon-clipping	MIT	Polygon operations.
dnd-kit	MIT	Drag-and-drop reordering in the project tree.
PDFKit, **React-pdf**	MIT	PDF report generation.
archiver, **unzipper**	MIT	Reading and writing .smz files.
electron-updater	MIT	Application updates.
Sentry	MIT	Error reporting.

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For more information about StraboSpot and related tools, visit strabospot.org.